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A Weekly Review of Current Electrical Progress

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Vol. VIII. NEW YORK, JULY 3, 1886. No. 1.

OUR NEW QUARTERS.

In our last issue it was announced that THE ELECTRICAL WORLD would remove immediately to its new offices in the Potter Building. The removal has now been made, and we have already settled down comfortably again. The change surprises and delights our friends, many of whom have hastened to call upon us with congratulations and good wishes. We want to have it well understood that the offices, with their superior accommodation and numerous conveniences, have been taken not only with the object of affording the room necessitated by the growth of the paper and its departments, but with the view, largely, of placing all its facilities more readily at the command of those engaged in electrical pursuits who desire information, professional advice or help of any kind, who wish to consult the files of the paper and its exchanges, or who in any way can be benefited by the command of our time and services. The latch-string is out.

THE present number is the first of Volume VIII. It may be well to remind our readers that binders for the paper can be had for a trifling sum, enabling them to keep their file clean, intact, handy for reference, and in good shape for preservation.

THE New York Electrical Subway Commission has pronounced in favor of a conduit of asphalt or bituminous concrete, upon the "drawing-in" system. A company will be formed to carry out the work.

WE publish this week additional letters sent in answer to our inquiries regarding the possibility of the universal adoption of the British standard wire gauge. Our investigations have thrown a flood of welcome light on the question.

THE Executive Committee of the National Electric Light Association has put affairs in good shape for the Detroit meeting, and our notes on the subject in another column will show that the convention is likely to be one of great interest and pleasure.

AS one result of the fight between the cable companies and the cut in rates, the shareholders of the French Cable Company have tried to oust the present management. At the semi-annual meeting, last week, they actually voted the directors out of office, but the directors declined to resign. Just what will happen now is not known, but the shareholders are evidently sick of the affair and tired of losing their money.

THE Republican members of the Pan-Electric Investigating Committee have presented a report, the nature of which has already been foreshadowed in these columns, giving the result of their labors, and summing up with a strong condemnation of the conduct of those concerned in the Pan-Electric scandal. The report is very long, and very scathing, and reflects not only on Mr. Garland and the other stock-jobbing officials, but criticises the Administration for allowing a suit to be brought against the Bell patent at the instigation of such men. The report puts the cost of the government suit at not less than $300,000.

WE are glad to note the fact that the ingenious idea of running small cars suspended from cables, by means of electricity, has been seriously taken up in this country, where the opportunities for its development are so numerous. England has such a line in operation already, so that a practical application is not wanting as an example. The system described in our columns last week differs from that in operation in England in the fact that two cables are used instead of one, so that no swaying of the suspended cars can take place. Hence, it would be adapted to passenger traffic as well as for the transportation of goods. Each week brings us nearer to the time when the electro-motor will be preferred as a source of power, its great adaptability being recognized more and more every day. We must confess that in the application of the electro-motor on a large scale we are at present somewhat behind European countries, but at the prevailing rate of progress this condition of things will soon be reversed.

GEN. MOLINEUX has a very good hobby in signaling, and he is carrying out his ideas in an eminently practical manner, as illustrated by his drill of the National Guard signal and telegraph men on New York Bay recently. But it seems to us he hardly goes far enough yet. Should his "intelligent mob" cut away telegraph wires, gas pipes and water mains, it would also be intelligent enough and strong enough to clap violent hands on the men who were code-signaling on the tops of high buildings. It could also obscure such signals by smoke and other means. But it would not be likely to know all the roundabout circuits open for communication between New York and Brooklyn. Moreover, flag codes, though they might serve by day, would be of no use at night, a time of greatest emergency. Here comes in the utility of balloon signaling, especially balloons equipped for signaling with incandescent lights. A mob, intelligent or otherwise, might not find it very easy to get at the balloons. But Gen. Molineux is on the right road, and will, doubtless, consider all these things.

THE light-giving value of the incandescent lamp has been the subject of considerable discussion, which has been confined principally to the method of measurement to which the lamp is subjected. With the ordinary gas flame the difference in direction in which light is measured, whether on the flat side or edge, is of little account; but in the incandescent lamp such is not, as a rule, the case. Lamps, the filaments of which vary in character and form of contour, show considerable variation in illuminating intensity according to the position in which they are placed in the photometer. Hence, whereas with the gas flame measurements in two or three directions are sufficient to obtain a good average intensity, the incandescent lamp must for the same purpose be measured in an increased number of positions. Mr. Alex. P. Wright, Mr. Weston's able assistant, who has made the photometry of incandescent lamps a special study ever since the latter came into practical operation, begins in this week's issue a description of the proper methods to be adopted in order to obtain their true illuminating value. No one, probably, is better fitted to discuss this important subject, and we, therefore, commend the article to the attention of our readers. Mr. Wright, it may be mentioned, speaks from an extended experience, not only with incandescent lamps but with other illuminants.

IT is strange to note how conservatism leads some men to cling to old devices and arrangements even after new ideas have been demonstrated to be perfectly practical. Thus, according to an English contemporary, some engineers still speak of electric lighting as untrustworthy, and one of them recently refused to light an underground railway in this manner, chiefly on account of its *uncertainty!* When arc light circuits, in which a single break means extinction of all the lights, operate for years without one interruption, it is time to lay aside the idea of uncertainty regarding the electric light which seems still to linger in some prejudiced minds. As an offset to this episode, however, we note that another English railway engineer has installed what is perhaps the largest isolated plant, or central station, if it may be so called, thus far undertaken in England. This is at the Paddington Railway station in London. The new legislation which will probably soon be adopted in England, while not entirely satisfactory to all concerned, will probably see central station lighting begun in earnest there, and pushed with true British vigor.

THE astonishing facts revealed by the late researches on self-induction of Prof. D. E. Hughes and the great practical bearing which they have, have attracted world-wide attention, and, as was to be expected, have also called forth considerable discussion regarding the truth of that investigator's deductions. The demands on our space have prevented us from entering at any great length into the details of this discussion, and Professor Hughes had, moreover, promised in his first paper to give additional data and experiments at some future time. This promise he has now fulfilled, and we print in to-day's issue the first part of what may be considered as an answer to the objections which have been raised against his method of research. It will be observed that he employs a modification of his previous instrument used for the purpose, and he enters more into details than on the former occasion. These experiments are of the most interesting character, and cannot fail to impress the reader with the conviction that a vast field has been opened for researches of which a practical application lies immediately at hand.

THE method of recording telephonic conversation, devised by Professor Bell, Dr. C. A. Bell and Mr. Sumner Tainter, which we described in the issue preceding the last, has called forth an interesting article from Mr. W. E. Irish, some of whose inventions in telephony we have already had occasion to notice. Mr. Irish makes an excellent addition to the various methods which have been employed by Professor Bell and his associates for obtaining currents in conformity with the vibration of gas-jets, by the employment of a thermopile in the circuit acted upon by the flame. He also describes the method of obtaining a photographic record of speech, but lays great stress upon a method which, we believe, is entirely original, and certainly most ingenious and simple in its details. By this method speech is recorded in ink, in characters similar to those familiar in stenography, and which, according to Mr. Irish, are readily deciphered after a little practice. If this should prove to be the case, there would seem to be nothing in the way of recording conveniently all telephonic conversations. That some method for this purpose is necessary is now an admitted fact; and the many valuable uses to which it could be adapted, and the work already accomplished, leave no doubt as to its early practical application. It would, indeed, enhance the value of the telephone tenfold, and would make this instrument perfect in every respect.

A RECENT writer on the subject of "The Electrical Age" gives an interesting picture of the future state which will find the subtle force in universal employment. That this idea is by no means a new one born of facts of comparatively recent development is instanced by a quotation cited by the same writer, which shows that the prophetic ken of science was happily exhibited by Dr. Lardner in his treatise on the steam engine. "Philosophy," said he, half a century ago, "already directs her finger at sources of inexhaustible power in the phenomena of electricity and magnetism, and many causes combine to justify the expectation that we are on the eve of mechanical discoveries still greater than any which have yet appeared; and that the steam engine itself, with the gigantic powers conferred upon it by the immortal Watt, will dwindle into insignificance in comparison with the hidden powers of nature still to be revealed, and that the day will come when that machine which is now extending the blessings of civilization to the most remote skirts of the globe will cease to have existence, except in the page of history." Thus even at that early day the dawn of the present new era was foreseen and hailed by one treating of the machine which has contributed perhaps more than any other to place the dynamo upon the prominence which it now occupies. But as change and improvement are constantly taking place, it might not be uninteresting to inquire: What will supersede the dynamo and electro-motor? What age will follow this dynamo-electrical age? We confess our inability to answer this question, except to suggest the age of light, with the selenium cell as its chief motive agent.

REVIEWS OF NEW BOOKS.

DIE TECHNIK DES FERNSPRECHWESENS. By Dr. V. Wietlisbach. With 123 illustrations. Vienna, 1886. A. Hartleben. 264 pp. 12mo. Price $1.00.

This excellent little book forming Vol. XXXI. of the "Elektrotechnische Bibliothek," is designed by the author to give a synopsis of the most approved methods actually employed at present in telephony. He does not confine himself to certain systems, but discusses from a practical stand-point the various departments and accessories which go to make up a telephone system; and he does this in a most interesting and instructive manner. Quite a number of the illustrations and part of the text are reproductions of articles which have appeared in THE ELECTRICAL WORLD during the last two years, for which the author gives us due credit in the preface. American practice has, therefore, by no means been neglected, so that on that account, if upon no other, the book is of value to American readers who are familiar with German.

DIE ELEKTROTECHNISCHE PHOTOMETRIE. By Dr. Hugo Krûss. With 55 illustrations. Vienna, 1886. A. Hartleben.

This is a companion volume to the above, and is a concise treatise upon a subject of growing importance. Photometrical measurements of true comparative values are difficult to obtain under ordinary circumstances, and it is only by exercising the greatest precautions that they can be relied upon. The author, after describing the principles of photometry and the various photometers developed therefrom, discusses the points which must be considered in judging of the lighting value of an illuminating source.

The book is admirably arranged, and contains much valuable matter which is here put in book form for the first time. Not the least valuable part of its contents is the classified index to the literature on the subject.

ABRIDGMENT AND DIGEST OF U. S. PATENTS ON UNDERGROUND ELECTRICAL LINES. By James W. See, E. E., etc., etc. Published by the author, Hamilton, Ohio. 16mo, 344 pages. Price $10.

At the present time, when the interest in the question of underground wires is so widespread, this book has a special and peculiar importance. Its leading features may be thus summarized: 1. The abridgment of each patent recites every exhibit of the patent, whether such exhibit be involved in drawing or specification. In this respect the abridgments differ radically from the very unsatisfactory extracts found in the abridgments of English patents. 2. The claims are given in full. 3. Full indexes are provided, both chronological and alphabetical. 4. The digest is exhaustive and thoroughly analytical, omitting no details. It is thought that this is the first published example of a thoroughly analytical digest of a given class of patents, the digest accompanying the English abridgments being little more than general indexes.

The book comes down to Jan. 1, 1886, in its abridgment, and gives a digest of no fewer than 7,000 references.

Mr. See has prepared also a volume of 1,800 imperial 8vo pages containing over 1,600 figures of drawings, and a digest the same as above, with 7,000 references. It consists, in fact, of complete official copies of all the United States Patents to Jan. 1, 1886, in Sub-class "Underground Lines." The price of this larger compilation is $50.

We can cordially recommend both publications to those whose interests necessitate familiarity with the subject. Mr. See has done his work thoroughly, intelligently and helpfully.

PROCEEDINGS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION: Second Annual Convention, Baltimore, February, 1886. 222 pp. Price, $2.

In its two substantial volumes of transactions the Association has more than justified its existence. This second publication is in various respects far more meritorious than the first; and both together constitute a valuable fund, not only of theories advanced by those who are ready with interpretations of new data, but of practical information gained at the expense of many a gray hair and sleepless night by men actively engaged in the supply of electric light. Turning the pages of the handsome issue now under notice, we are surprised as well at the variety of topics embraced as at the vigor and freshness of their treatment and discussion.

The publication is furnished free to all members of the Association, and non-members can obtain copies at $2 each by addressing either the Secretary or the office of THE ELECTRICAL WORLD.

Damascening by Electrolysis.

A method of damascening metals by electrolysis has been brought out in France. Two copper plates are put into a bath of sulphate of copper solution, one being connected with the positive pole and the other with the negative pole of a battery. A thin layer of insulating varnish or wax is spread over one of the copper plates, viz., that connected to the positive pole, and the damascened device is etched on it. Now, since copper is by electrolysis transferred from this plate to the other plate, it follows that only the lines of the drawing can be attacked. A battery of two cells is sufficient for this purpose. When the plate has been bitten to the depth of a millimetre it is removed from the bath and treated with hydrochloric acid to remove traces of oxide of copper in the lines of the drawing. It is then washed with water and suspended in a bath of nickel and silver and connected with the negative pole of the battery. The positive pole now consists of a plate of platinum. The silver or nickel deposits wherever the copper has been attacked, and the depressions are soon filled with the foreign metal. The plate is then polished, and looks like one which has been damascened by hand.

Photometric Measurements and Their Relation to the Efficiency of Incandescent Lamps.

BY ALEX. P. WRIGHT, C.E.

(Copyright 1886.)

To compare the relative efficiency of incandescent lamps it is not merely sufficient that the electrical measurements should be made with accuracy, but the measurement also of their illuminative intensity should be estimated with precision. While great care is usually taken to insure the accuracy of the electrical measurements, the photometric observations are frequently as crude as the instruments with which they are too often made. Again, while these measurements, when carefully conducted with a good photometer, give results which show the relative illumination of lamps having filaments of the same configuration and dimensions, they in almost all instances fail in showing either the true mean illumination or the relative lighting value of filaments of varying form, length and section.

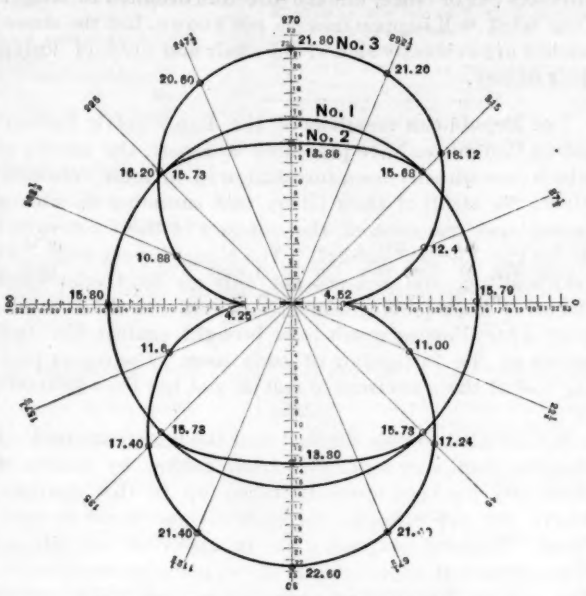


FIG. 1.—PHOTOMETRIC MEASUREMENT.

It is the object of these articles to point out the fault in the customary methods of photometric measurement as well as to suggest a system for obtaining more accurate and uniform results. In the first place the steps will be traced by which a remodelled method is arrived at; a system of spherical measurements will be described and a few memoranda will be given as to the best arrangement of photometric apparatus, such as have been suggested by a long, practical experience in photometric work extending over a period of 17 or 18 years, during which many thousands of tests were made of candle, oil and gas flames as well as of arc and incandescent lamps.

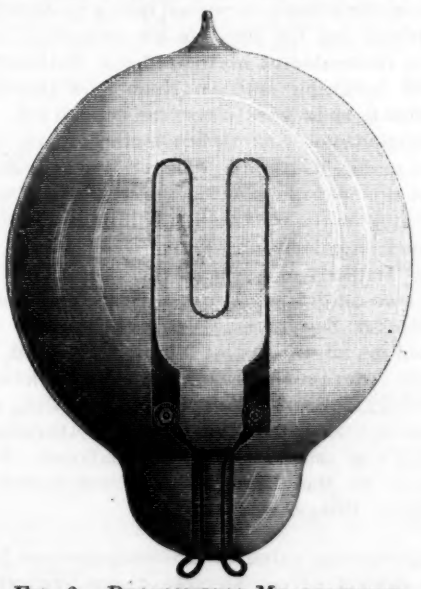


FIG. 2.—PHOTOMETRIC MEASUREMENT.

It is the practice in testing gas photometrically to set the flame in one position only for observation, and to accept the reading as the value of the light. A luminous gas flame does not obstruct all the rays which are projected from the portions which are anterior to the surface presented to the instrument, so that although at first one might be led to expect that the difference between the amount of light emitted from the face and the edge of a flat flame to be very great, the intensity in each case being proportional to their respective areas, this is not the case; as a matter of fact the difference is somewhere in the neighborhood of 12 per cent. This difference varies with the quality of the gas and the dimensions and shape of the flame.

The accepted method of testing, therefore, does not give the true mean illuminative effect, even in a horizontal plane. To obtain that the flame should be, as it is not, turned on its vertical axis to bring it into different positions with regard to the photometer disc; observations being made in each position and the mean of the readings computed.

When the flame is cylindrical, as in an argand burner, the readings are practically uniform, so that any one position gives the mean effect in a horizontal plane. But neither in the case of a flat nor of an argand flame is the true mean effect in all directions obtained.

With an incandescent filament, although there is reason to suppose that in many cases readings are made for one position only of the filament, it is usual to turn the lamp on its vertical axis and the mean of a number of readings in different positions is accepted. This is obviously necessary when it is considered that the opacity of an incandescent filament allows only the rays emanating directly from the surface turned to the photometer to fall on the disc, and such as are reflected from the interior surface of the glass envelope in which the filament is inclosed. But as this will be equally true of a gas flame inclosed in a shade or chimney, it is proposed for the present to simplify matters by neglecting the reflected rays, which are only referred to here in order that it may not be imagined that they have been overlooked.

It is sufficient, then, at the present stage to consider all the rays as direct and to grant, for the time being, that a gas flame is transparent. The photometric readings of a gas flame are on this assumption the same at all inclinations in a horizontal plane, irrespective of the superficial area presented to the disc, while in an incandescent filament they are proportional to the area of surface under observation. It is, therefore, necessary to take the mean of a number of readings in various positions of the loop.

An argand and a flat flame of 15.79 candle-power (accepted) if measured in different positions would give equal readings and the curves if plotted as in Fig. 1 are found to be circular (curve No. 1), the mean being 15.79 candles.

This is the fact as regards the argand; but if a flat flame, whose face reading is 15.79 candles, be measured in different positions, the intermediate readings from the faces to the edges gradually diminish. As shown in curve No. 2, Fig. 1, which is plotted from actual measurements, the mean of the readings being 15.265, *i. e.*, less than 15.79 candles.

The curves plotted from incandescent filaments vary considerably in configuration and depend upon the form and section of the loop, in some cases the greatest photometric readings being on their edges and in others on their faces.

Curve No. 3 is plotted from measurements made of an M-shaped loop (Fig. 2), which is chosen as an extreme case in order more graphically to illustrate the necessity for readings of an incandescent filament in various positions.

Table showing the relative areas of the faces and edges of an M-shaped filament and the corresponding photometric readings, and the ratios respectively between the surfaces and the readings:

	Surface area; sq. in.	Estimated ratio of readings.	Mean photometric readings in c'ndles.	Actual ratio of readings.
Face..... ..	.0887	4.8	22.20	5.045
*Edge.....	.01848	1	4.40	1

* On account of the difficulty of obtaining a lamp in which the loop was perfectly flat, so that one leg of the loop might be set in the photometer to obstruct the rays of light from the other three, a lamp was chosen in which the edges of the four legs were unobscured as in Fig. 2 in order that the amount of surface might be positively known.

The ratios in the second column, while they do not correspond exactly with those in the fourth column, as might be expected, taking into account the reflection and obstruction due to the glass envelope, approximate sufficiently for the purpose of illustration.

No further remarks will be needed to point out the great differences which might exist in the estimation of the efficiency of such a lamp dependent upon the mean of a number of observations being made in a horizontal plane, or simply on the face or edge or at some intermediate position.

The practice has been in this country, in the majority of cases, to take the mean of a number of measurements in the horizontal plane of an incandescent lamp filament, and this method is known by a few of those engaged in such measurements as the "Horizontal C. P.," as distinguished from "Face C. P." (sometimes "Flat"), "Edge C. P." or "Spherical C. P." This practice is not, however, universal. I have tested many lamps claimed to have a certain candle-power at a given E. M. F., but have frequently found them to fall considerably short when tested for "Horizontal C. P.," although there were positions in which the readings (always the greatest) satisfied the claims, but the corresponding (Horizontal C. P.'s) fell short of the pretensions.

This is more notably the case with European lamps. I

was not long engaged in testing incandescent lamps when I came to the conclusion that this was the case, and I was subsequently confirmed in that opinion during a visit to London at the time of the Fisheries Exhibition. On a visit to this exhibition I drew the attention of my companion, a gentleman engaged in the manufacture of incandescent lamps, to the lack of candle power of individual lights, and remarked that they were below their normal 16 candles. He replied that they were up to standard, to which I remarked that if that were so the candle increased after importation to America, as I specially imported for Mr. Weston's laboratory candles from the best London maker.

The matter dropped at the time, but a few days afterward, while visiting an incandescent lamp factory, with the same companion, I naturally stopped to inspect the operation of grading the lamps. They were placed in the photometer with the greatest illuminating surface to the fore and the current adjusted to give a 16-candle reading, and the corresponding E. M. F. marked on the lamps.

Conmercially in my work I use the horizontal method. but for a long time past I have been in the habit of using a method to be described in a subsequent article, for obtaining the "Spherical C. P.," whenever it is desired to test for comparative values.

(To be continued).

National Electric Light Association.

A meeting of the executive committee of the National Electric Light Association was held on the 29th ult., at 3 P. M., at the Hotel Dam, Mr. A. J. de Camp presiding. The other members present were Messrs. J. Frank Morrison, president; E. T. Lynch, Jr., and Dr. Otto Moses. Mr. T. McCoubray, Jr., the secretary, was in attendance.

From the committee to tabulate standard rates for furnishing lights, Mr. H. W. Pope reported progress; as did Mr. R. W. Pope from the committee on standard wire gauge.

Mr. E. R. Weeks, of the committee on underground systems, reported progress, and promised an emphatic protest, in due course, against an enforcement of the use of underground wires.

Mr. J. F. Noonan, of the committee on transportation, reported that members of the Association would be able to make the round trip to the Detroit meeting in August for 1¼ rates.

Mr. A. Steuart, of the legal committee, sent an outline plan of a legal department for the Association, modeled on the lines of that existing on behalf of the railroad companies for mutual defense in legal matters. This legal department should help members in patent and other disputes of importance that might arise affecting their status and operations, and should be in charge of the president and the executive committee, who would select a general counsel. Mr. Steuart will bring the matter before the Detroit meeting.

Dr. Moses, from the committee on the proposed bureau of information, suggested a basis of operation, the chief points of which are the establishment of such a bureau with headquarters at New York, the appointment of a statistician, and the assessment of companies using the bureau, on the principle of so much per lamp. This also will be brought up at the Detroit meeting.

Mr. de Camp reported progress from the committee on relations between parent and sub-companies.

Papers were promised by Mr. J. A. Pentz on the transmission of power from engine to dynamo; Mr. C. C. Haskins on wire joints; Mr. G. H. Benjamin on accumulators; Mr. C. O. Baker on platinum; Mr. T. C. Martin on electric motors; Mr. A. Steuart on patents in electric lighting; and Mr. M. Lee Ross on the mutual insurance of stations question. Several other papers are also to be read.

It appeared that no hotel had yet been selected at Detroit for the meeting of the Association by Mr. Fitzgerald, the local committee, but it is understood that full information on the subject will shortly be given, as soon as a choice of place has been made.

The Committee then adjourned to meet again a day or two before the opening of the Detroit Convention. There is every reason to believe that a very enjoyable time will be had by the Association at its August gathering.

The Fund for Lineman Rhodes.

To the Editor of The Electrical World:

SIR: In behalf of N. J. Rhodes, our faithful lineman, I desire to extend his sincere thanks to those who so kindly responded to my card, which you published, asking for help to replace his house and household goods that were so badly damaged by the flood in March last. The names and amounts are as follows:

Dave Harris, $1; J. M. Stephens and force, Atlanta, $10 T. F. Howel, $5; C. E. Woodruff, $2.50; J. N. Kiker, $1; B. J. Hughes, $1; E. Hogshead and force, Meridian, $5; Miss Maud Phillips, Memphis, $5; J. E. Fenn, $5; Luther Gwaltney, 50 cents. To Mr. Fenn, Mr. Rhodes desires to return his especial thanks and gratitude for his kind letter of sympathy.

W. H. ADKINS,
Rome, Ga. W. U. Manager.

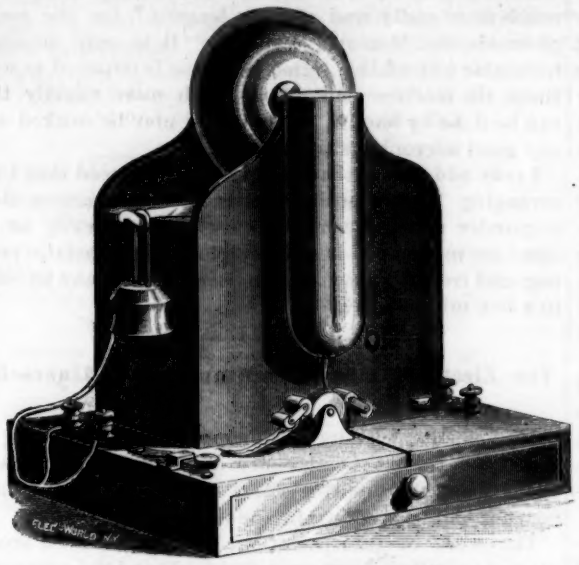


FIG. 1.—IRISH'S SPEECH RECORDER.

A New Method of Transmitting, Recording and Reproducing Speech.

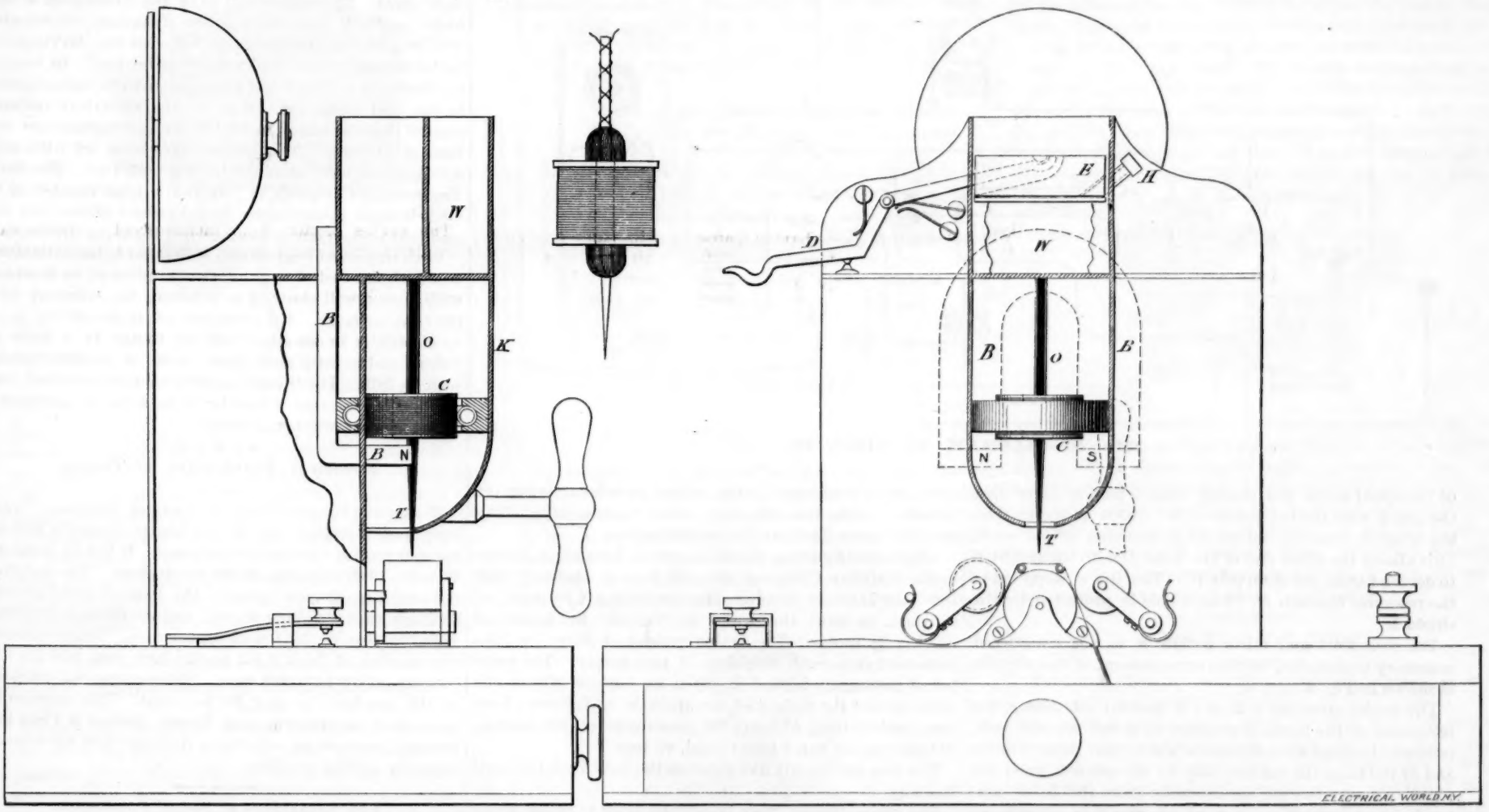
BY W. E. IRISH.

On taking up THE ELECTRICAL WORLD recently my attention was specially drawn to the above heading, having myself been a hard worker to accomplish the same object since the introduction of the telephone, and having taken out patents in Europe, in 1884, for a "Telephonograph or speech recorder, an apparatus for receiving and automatically recording articulated speech and other sounds transmitted telegraphically, telephonically or otherwise, by the aid of electricity." For a considerable time prior to the date of my patents in Europe, I carried out a series of experiments similar to those illustrated and described under the above heading in your issue of the 12th inst. as the invention of Prof. Bell and Mr. Sumner Tainter. With due regard to the wonderful inventive genius and indefatigable labor of these gentlemen of everlasting fame, and without any desire whatever to detract in the slightest any merit due to them, I submit that my system, as left by me over three years ago, was a considerable advancement and much more practical than their's, as described in your journal, and as I understand it to be.

I found that a jet of lighted gas could be made to reproduce articulated sounds without the aid of any electric telephone, such as employed by Prof. Bell, by a simple modification of "König's" well-known method of indicating the nature of sounds by a gas flame. I further found that by passing a sensitive paper rapidly before the jet which was exposed through a slot only to the traveling paper contained in a darkened chamber, a record of the pulsations of the gas jet could be readily obtained.

I also discovered that a fine jet of lighted gas could be made to transmit sounds telephonically; and I will now describe my apparatus, as experimented with prior to 1884: The transmitter consisted of a metal chamber or cylinder supplied with a combustible gas at a fixed pressure; one end of the cylinder was covered with a flexible diaphragm, over which was fitted a mouthpiece after the style of that furnished with Edison's phonograph. The other end of the cylinder was fitted with a stout metal plate, made perfectly rigid, and having fixed in its centre and projecting from it outwardly a fine tapering tube which was directed on a thermo-pile connected electrically with a telephone and recorder. On speaking to this transmitter, the flexible diaphragm vibrated in unison with the sounds, and the gas contained in the chamber was, consequently, more or less compressed above or below the normal pressure, and correspondingly forced through the fine tube, increasing or decreasing the length of the lighted gas jet, which was directed in the most advantageous manner against or toward the thermo-pile. I note particularly that no mention is made of Professor Bell having employed the thermo-pile, which, if not indispensable, is certainly the best means by which a really practical and useful result can be obtained from gas.

The recorder employed with this transmitter simply consisted of an ordinary telephone having a fine tube projecting outwardly from the centre of diaphragm, the chamber under or behind the diaphragm being supplied at a uniform pressure with a combustible gas. In operation



FIGS. 2, 3 AND 4.—IRISH'S METHOD OF TRANSMITTING AND RECORDING SPEECH.

the gas was lighted and the light received through a slit on a traveling sensitized paper. This arrangement, although giving satisfactory results, necessitated the employment of gas; and sensitized paper was, I considered, too complicated and troublesome for commercial purposes generally.

I, therefore, tried with some success to modify the system thus: A variable pressure ink-well or reservoir was rigidly fixed, having a flexible tube passing from the bottom and connected with a fine, glass pen. The pen passed through and was securely fixed to a flexible diaphragm which was firmly held at its circumference. From as near as possible the centre of this diaphragm there projected a tongue of soft iron, its free end resting at right angles on the core of an electro-magnet, to which a revolving motion could be imparted. In action, the soft iron tongue clung more or less to the revolving core of the electro-magnet, according to the amount of electricity passing through it (after the manner of Edison's chalk telephone), and acting upon the diaphragm, caused the pen to vibrate in all directions and record its movements on the traveling paper.

I have succeeded in accomplishing the recording of speech and other sounds in several ways similar to the system described in THE ELECTRICAL WORLD of recent date, but consider no method or system so good and simple as that patented by me in 1884 with recent improvements.

The apparatus as originally designed is shown in perspective in the engraving, Fig. 1, and in sectional detail in Figs. 2 and 3, which represent it in perhaps its most simple, although not most perfect, form. *B* is a permanent magnet over the poles of which the bobbin *C* is freely suspended by means of the flexible conducting wires which are twisted in reverse spirals. Through the centre of the spiral wires the flexible tube *O* passes, connecting the pen *T* with the ink reservoir *W*, which is operated by the lever *D*, when the telephone is removed off the hook. This allows the other end of the lever *D* with its weight *E* to descend upon the reservoir *W*. The ink is supplied to the reservoir through *H*. The whole is protected by the shield *K*.

The clockwork and other details it is not considered necessary to describe, but the arrangement of the circuits is shown in Fig. 5.

The *modus operandi* is thus: A person, on taking the telephone off the hook, in response to a call on the bell, releases the clockwork which forwards the paper ribbon and at the same time causes ink to be spurted upon the paper in a very fine jet continuously from the freely suspended pen, which is caused to move in accordance with the current passing through the bobbin *C*, which corresponds with the sounds transmitted through any good carbon transmitter. A distinct sign or figure is given for every sound. A person with his ear to the telephone hearing each word of a message as it is spoken by the sender, and at the same time keeping his eyes on the record and noting the signs corresponding to the sounds, can hardly fail in spite of himself to pick up a thorough knowledge of the system in a very short time.

Compare Figs. 1, 2 and 3 with Figs. 6 and 7, page 273 of THE ELECTRICAL WORLD, and note the resemblance in design. Fig. 4 also shows a modification of the apparatus, by means of which the permanent magnets are removed and the movement of the bobbin is caused by dynamic induction between the suspended coil and surrounding bobbin.

In 1884 I published a circular in which I said: "One of the chief hindrances to the development of the telephone to its fullest measure of usefulness has hitherto been the absence of any means of obtaining a written record of the messages as they are being transmitted or received. In consequence, many firms will not execute orders received by telephone until they have been repeated or confirmed in writing. The removal of this difficulty is one of the objects of the telephonograph or sound recorder. The instrument may be connected and will work on any telephone line in connection with the ordinary telephonic apparatus, or it may be employed without a telephone receiver and used simply for recording the spoken thoughts of literary and commercial men in their own office."

I said also: "The sound signs are not unlike those of Pitman's phonography, but are more clearly defined and much more easily and quickly learned," for the reason given above. Moreover, I added: "It is only necessary to be able to read the signs, as no one is required to write them, the machine doing that much more rapidly than can be done by hand. The recorder may be worked with any good microphone transmitter."

I may add that at that time I also announced that I was arranging "the recording portion of the apparatus above a cylinder which is caused to revolve uniformly as the signs are made upon it, to be employed for anastatic printing, and from which many thousand copies may be taken in a few minutes."

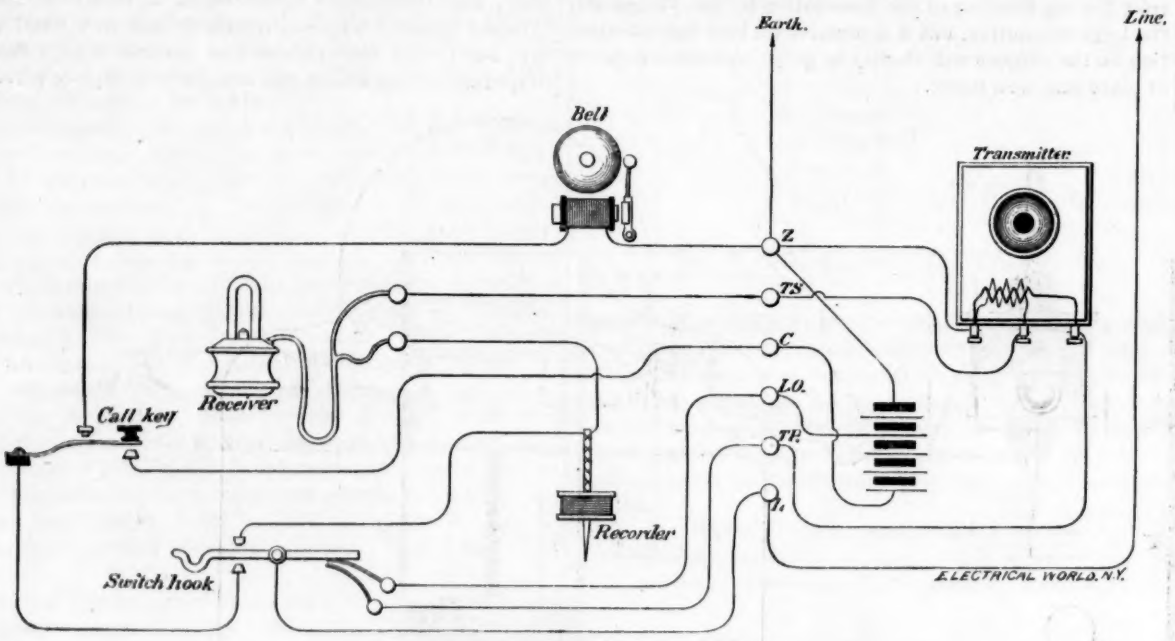


FIG. 5.—DIAGRAM OF CIRCUITS.

The Electric Railway at Minneapolis, Minnesota.

Minneapolis, with its phenomenal growth, has for the last few years felt the necessity of rapid transit between the city and the suburbs, where cheaper homes and more comfort can be obtained by the multitudes.

The work of transportation has hitherto been accomplished by railway cars propelled by 75 and 80 horse-power steam dummies, which came down into the heart of the city with trains packed full. Of late, however, the residents along the streets where the railway passes, and the public in general, have proclaimed the steam dummy a nuisance, and have succeeded in stopping its coming down in the thickly occupied parts, so that in order to bring the traveling public into the city, some means, other than steam or horse flesh, had to be restored to.

After some figuring, the Minneapolis, Lyndale & Minnetonka Railway Company entered into a contract with the Van Depoele Electric Manufacturing Company, of Chicago, to haul the trains in the city by means of its electric motor. The trains consist of three or four passenger cars, each weighing 11 tons empty. The number of passengers carried is often as high as 600 at one time, so that the weight of the train is as follows: Four cars, each 11 tons, 44 tons; 600 passengers at 130 pounds, 39 tons; motor car, 8 tons: total, 91 tons.

The cars are exactly like those on the New York Elevated Railway.

The steam dummy now brings the train to as far as the steam is allowed, and then the electric motor relieves it and takes the train down town with its passengers.

As soon as the cars are emptied, the waiting throng rushes in, and in less than a minute the train is moving toward the dummy again, there to deliver its train and to receive an incoming train to be brought down once more.

This operation of the electric motor begins at six precisely in the morning, and closes at half-past eleven or twelve at night. The distance over which the electric motor travels is at present somewhat near a mile, the speed being about seven miles per hour; this being the regulation speed within the city limits. Considering the constant stopping and starting at each block, the grades in the road, and the heavy trains, the electric motor must be given the credit of doing at least as good work as could be expected or obtained from any steam engine. During the seventeen or eighteen hours of service, not a single minute of stoppage is made, except to let off and take on passengers. This electric road has been in operation for several weeks without a hitch or a breakage. The motor, which is about 40 horse-power, works as perfectly under a heavy as under a light road. The electric generator furnishing current to the motor is driven by a 12 × 18 inch cylinder engine, common slide valve, making 125 revolutions per minute; steam 60 or 80 lbs. per square inch. The consumption of coal in 18 hours' run is 3,000 lbs.

From the permanency and the character of work done by this electric railway, it will be seen that electric railways on elevated, as well as on ordinary roads, must become facts in the immediate future. They are indeed now with us, and there is no more trouble to build two or three hundred horse-power generators than to build machines of 50 horse-power. Several of these machines can be connected up and run in perfect unison, and by adding their currents together, any amount of power can be transmitted with at least as much reliability as by the steam boiler.

Electric motors and generators are, and can be constructed to-day, which will equal in life any steam engine, and from the very nature of these machines it becomes possible to use less expert attendance than in the case of a steam locomotive. The parts being fewer and less liable to get out of order on an electric motor than on any other kind of motor, it must and will become a favorite in the industrial world. The public is losing their skepticism, and what was proclaimed as an impossibility yesterday has become a fact to-day.

The Newton, Mass., Street Railway Company.

The Street Railway Committee of the Massachusetts Legislature has reported a bill to incorporate the Newton Street Railway Company, with $50,000 capital and authority to employ the electric system of motive power and to lay tracks from the Boston & Albany Railroad in Newton Centre, north through Institution avenue to Beacon street, thence west to Walnut street, thence north to Washington street and Auburn street to Auburndale; also from this corner east through Washington street to Newton Corner; also from Bowers street, in Newtonville, to connect with the proposed line on Walnut street. The steam plant for running the dynamo-electric machines will be installed by the Jarvis Engineering Company, of Boston, and will include power enough to run an electric light plant. The engine will be of the Armington & Sims make, and will belt direct to the dynamos. The boilers will be made of Otis steel and set with the Jarvis patent boiler setting to burn coal screening for fuel. In running an electrical railroad the principal item to be considered is the cost of power. Most of the electrical railroads started thus far have put in long stroke engines and used lines of shafting. The boilers have been set with plain settings, and have used the highest cost fuel. The Jarvis Engineering Company has erected a large number of the electric light plants in the New England States, and it is said that every plant it has installed is paying dividends.

With improved engines and boilers set to burn the lowest cost fuel, the cost of running street railroads, as compared with horses, will show, it is believed, an economy of 50 per cent. or more. The prospects of transmitting power by electricity to run street cars are to-day in a more advanced and hopeful state than those of electric lighting were in 1878. The thing is already an accomplished fact. All that is necessary is to enlarge the scope of operation by increasing the number of plants.

Electrical Purification of Copper.

Messrs. Sir Hussey Vivian & Sons, of Swansea, Wales, have just installed one of the largest dynamos hitherto constructed for electrolytic purposes. It has an output of 50 volts, 1,000 ampères, at 400 revoluuions. The weight of the entire machine is 5¼ tons; the magnet limbs are solid forgings, each weighing 22 cwt., and are shunt-wound only, each limb having 260 lbs. of copper wire. The armature is constructed of bars 0.338 square inch area, and has a resistance as low as 0.0016 ohm. The commercial efficiency of the machine is over 93 per cent. This dynamo has given such satisfaction that Messrs. Mather & Platt have recently received an order from the same firm for a second precisely similar machine.

The Variations of Ships' Compasses.

The variation of the needle, says Sir Thomas Browne, "may proceed from mutations of the earth, by subterraneous fires, fumes, mineral spirits or otherwise; which, altering the constitution of the magnetical parts in process of time, doth vary the variation of the place." Had the nobly-eloquent exploder of "vulgar errors" lived in these days, says the *Daily Telegraph*, he would have added others to his list of the causes of the deflection of the needle; and not the least strange item in the catalogue would be the wearing of electric belts by rheumatic or debilitated sailors. "One of our crew here," writes the master of a steamer at Smyrna, "has a magnetic belt. I got it from him one day last voyage, and taking it on the bridge, I found that all three compasses were very much affected by it; in fact," adds the captain, "the highest compass of the three went reeling round and round." The moral he desires to point is that as—so at least he says—these belts are much worn by seafaring men, and firemen in particular, masters should be careful to find out what magnets their crew or passengers may happen to have with them, "either in the shape of belts or in any other form;" for, as he justly asserts, errors in the compass lead the seamen at times into terrible accidents.

Electrical Manufacturing in the South.

Whatever may be the condition of manufactures generally in the "new South," it is becoming more and more evident that in electrical industries that part of the country is well to the front. Baltimore may be taken as a city offering in a remarkable manner typical evidence of the development. It will be remembered that Baltimore has now had a practical electrical railroad in operation for nearly a year, and that there, too, some of the hardest and most satisfactory work with secondary batteries is being done. Visitors to the city during the meeting of the electric light men there last February were agreeably surprised to see the new four-story factory erected by Mr. J. F. Morrison, their associate and president, and known as Morrison's Electrical Works. At that time the factory was getting ready for business. It is now, however, in full swing, and is already so pushed that it has had to put the employés on double turn, night and day, each force working 9 hours. The Works are kept busy on a regular line of electric lighting, testing, and motor goods, but have had some unusual demands made on their facilities, and the successful execution is really worthy of very warm approval. One of the achievements is the recent construction of the second largest galvanometer in the world, for Messrs. Gatewood & Kielholtz, of Johns Hopkins University. The largest galvanometer is that at Cornell, and it is said that the new one compares with its prototype most favorably in design and workmanship. Another ingenious new instrument is one of application in the Signal Service, for atmospheric measurements and recording. It is of great delicacy and sensitiveness. Besides this, a demand is now made on the Works for general optical and scientific apparatus, and it can easily be understood that a great progressive institution like the Johns Hopkins University not only is glad to avail itself of the aid that such a factory affords, but in its investigations and experiments is continually creating opportunities for the performance of new, better and more difficult work. Quite another department to which the Works

FIG. 1.—DOMESTIC TELEPHONE.

have been paying special attention is that of motors, and excellent results have been obtained; while still other occupation is found in connection with secondary batteries. In short, when we recollect how recent is the time that reliance could first be placed in the finer electrical apparatus of home production, it seems little short of marvelous that at Baltimore an industry dependent upon the most skillful employment of trained hands and the latest investigations of science should have sprung into such immediate and unquestionable success. At this rate our Southern friends will more than hold their own.

Electric Gongs on German Railroads.

Tabulated statements of the number of electric gongs by which the approach of the train is announced from point to point, especially at crossings, on German railroads, make, says the *Railroad Gazette*, the mean distance apart of these gongs 950 metres, or 3,116 feet, and on Austrian railroads 1.04 kilometres, or 3,411 feet.

These gongs are arranged on a circuit between two stations and are operated analogously to the block system; that is, station A announces to B that a train is ready to start, whereupon, if B knows of no obstacle, he acknowledges the signal by giving "all right," and A then presses the key which causes the gongs between A and B to strike.

The German roads are now generally arranged so that this system is a perfect block, telegraph stations being inserted where necessary between the stopping stations; but on the light traffic roads B is allowed to give "all right" without having received the last train that went into the block.

It will be perceived that even where not used as a block system, and apart from the warning given to trackmen and crossing tenders, these bells, which can be heard nearly, if not quite, from one to another, are a considerable aid to safe working, since a train in the block always gets warning of another train entering behind it.

These bells are used by combinations of blows to give a variety of information, such as "Train toward A!" "Send over engine!" "Stop all trains!" "Set your watches—noon!" "Train backing up on wrong track!"

Domestic Telephony.

The application of the telephone for household communication is destined to a very wide range in the future here, and in Europe has already received considerable attention. A simple system of telephony for domestic purposes has been designed by Herr Friederich Heller, of Nuremberg, Bavaria, which we now illustrate. Fig. 1 shows the "station" as it appears on the wall of a room. It consists of a small desk-shaped box containing the well-known Ader microphone. In addition to the induction coil there is a dry pile within the box, and a small hand phone is sus-

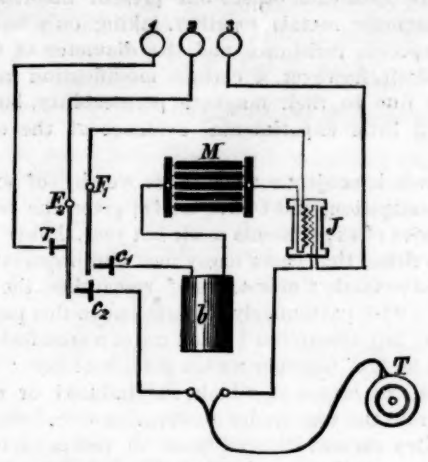


FIG. 2.—TRANSMITTER CIRCUIT.

pended from the hook. The diagram Fig. 2 shows the arrangement of circuits in the box, and Fig. 3 shows the manner in which it is connected to the general house circuits. Each room contains a push button t_1, the two springs of which are connected to the calling circuit by wires i_1 and i_2. These same wires, as shown, are connected to the binding posts 2 and 3 upon the telephone box K_0 in each room.

The method of operating the system is as follows: By pressing the button t_1, the circuit of the calling battery B is closed and the bell W rings. The current then passes from t_1 to the terminal 2 of box K_0, into the spring F_2 (Fig. 2), stationary contact r and terminal 1 to

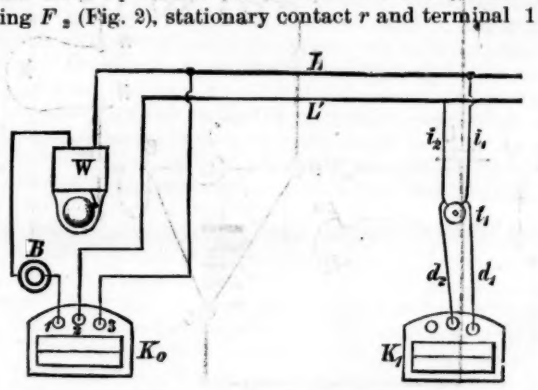


FIG. 3.—HOUSE CIRCUIT.

battery B, and thence to the bell W, back to the push-button t_1.

The telephone T is then carried to the ear, and the key shown at the front of the box is pressed down; the same operation is performed by the person at the other end of the line when the bell sounds. By pressing down the key the two insulated springs F_1 and F_2 are pressed against the contacts c_1 and c_2, Fig. 2. This breaks the connection of F_2 with contact r, and cuts out the battery B, and bell from the circuit.

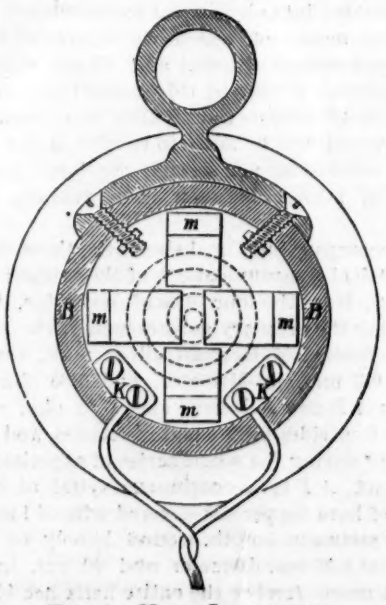


FIG. 4.—HAND INSTRUMENT.

The telephonic currents then proceed in K_0 from terminal 2 by spring contact F_2 (Fig. 2) and c_2 through telephone T, thence through the secondary of induction coil J and terminal 3 to the other telephone upon the circuit. The spring F_1 closes the circuit of the dry pile b at c_1, so that the current passes through the primary of J and the microphone M.

Speech is directed in the ordinary tone against the microphone plate, the key above mentioned being continually depressed. The arrangement of the hand telephone connected with the apparatus is shown in Figs. 4 and 5. Four steel magnets m m, bent at right angles, are inclosed in a hard rubber case B, and are fixed in position by a screw s, which presses the flanges a of the core Z against them. The bobbin S is slipped over the core, and K K serve as terminals of the bobbin and for the wires leading without.

"Ticker" Warfare in New York.

The struggle between the ticker companies and the New York Stock Exchange has begun again. President Smith, of the Stock Exchange, has been served with an injunction obtained by the Commercial Telegraph Company, restraining the Exchange from making any exclusive contract with the Gold and Stock or any other telegraph company for furnishing the quotations made on the floor of the Exchange. For a long time past the Exchange has collected its own quotations and sold them on equal terms to the Gold and Stock and the Commercial companies, which have in turn furnished them to the public over their ticker instruments. The Commercial Company, however, claims to have discovered a plot by which the Governing Committee of the Exchange intended to make an exclusive contract with the Gold and Stock Company, thus shutting off the Commercial from obtaining the quotations, without which the Commercial's ticker service would be practically valueless. Hence the injunction. Meantime the Stock and Produce Exchange brokers are carrying out a concerted movement against the bucket shops, which they declare they will not abandon until the concerns are driven out of the business. The shops are dependent for their business upon the regular receipt of quotations, which are sent out over "tickers" by the Gold and Stock and Commercial companies, and the brokers have succeeded in having the machines taken from several of the shops. It is charged that the quotation companies, in violation of the contract under which they are allowed the facilities of the exchanges, are surreptitiously allowing the use of their service to the illegitimate shops. The most serious allegation is that prominent officials in the telegraph companies are interested in a concern known as the "Big Four," that has its headquarters on lower Broadway, and is said to control 300 bucket shops in this and other cities. They employ 40 operators, and it is charged that they obtain their quotations by collusion with the interested telegraph officials. It is also alleged that a "general news" ticker has been put in use by the Com-

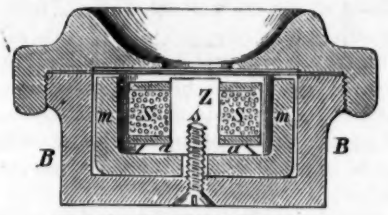


FIG. 5.—HAND INSTRUMENT.

mercial companies, which is simply an arrangement for furnishing stock quotations to the shops in violation of the contract with the exchanges. The quotations as sent out are furnished the companies by the Stock Exchange's own reporters, and it is said that the Governing Committee has evidence that this news is stolen and a regular business made of selling it to outside parties. The whole squabble is believed to be preliminary to a bitter contest between the exchanges and the "ticker" companies.

A New Secondary Battery.

Herr Kalischer has devised a secondary element of iron and lead in a concentrated solution of lead nitrate. The iron anode is passive, and with currents not too strong becomes coated with coherent thick layers of black peroxide of lead, which protect the iron from contact with the liquid and from decomposition. The change is completed when gas is freely liberated at the anode, and the liquid gives only a slight precipitate with sulphuric acid. To prevent lead growths between anode and cathode, amalgamated lead in contact with mercury is used. In discharging, the peroxide becomes brown and changes into monoxide, then into black peroxide. The electromotive force is from 2 to 2.5 volts, but sinks when the current stops, to 1.8 volts. From its solubility in nitric acid the lead cathode must be occasionally replaced. Carbon can be used instead of iron.

The Edison Company's Attitude.

The following expression of its views and intentions on pending litigation is given out by Mr. Edward H. Johnson, President of the Edison Electric Light Company:

"The Edison Electric Light Company, having instituted suits on its patents, must decline to substitute the columns of the press for the courts for the purpose of their legal interpretation. Mr. Edison's carbon filament patent of 1879 covers broadly the modern incandescent lamp. The claim that this patent has ever been in litigation in the United States Patent Office is absolutely false. In Germany and England this fundamental patent has finally

prevailed against all infringers, thus establishing the fact that Mr. Edison's great invention has been nowhere anticipated—*ergo*, a like result must follow in the United States. The straining and distorting of these facts, together with the violent effort to interweave with them certain minor and irrelevant cases for the purpose of fraudulently posing before the public as joint-heirs with Mr. Edison in the fruits of these patent decisions, only indicate the dire extremity of those who are thus gradually becoming environed by due process of law."

An International Wire Gauge.

We publish below three letters, supplementary to those given in our issue of June 19th, relative to the adoption in this country of the new English legalized standard wire gauge, now recognized in England, France and Germany, and formally approved by the National Telephone Exchange Association and the National Electric Light Association. The letters now given are of special value and importance, presenting as they do the views of the largest wire makers in the world, of the largest telephone exchange system, and of the electrical department of Philadelphia.

WASHBURN & MOEN MANUFACTURING COMPANY.

To the Editor of The Electrical World:

SIR: Answering your favor under date of the 24th ult., which would have been more promptly answered before but for the pressure of other matters, we have to say that with reference to general wire purposes the new British wire gauge has not become very generally known in this country; in fact, we have not a single one on the premises, although we have had occasion to refer to it in our little "Pocket Hand-book of Iron and Copper Wire in Electric Transmission."

For the last fifty years, which substantially cover the history of wire manufacturing in this country, the Stubbs or Birmingham English gauge was at first the only, and up to the present time has been one of the leading gauges; next after that came the Washburn gauge, which has been very generally adopted, and is largely in use by our own company; and then followed the Brown & Sharpe new standard gauge, which last has been constantly gaining favor, and is, and has been for some years, the only gauge referred to in connection with brass and copper wire.

No other wire gauges have as yet been adopted to any considerable extent.

It is our judgment that gauges with fractions of an inch as a basis—*i. e.*, one-thousandths of an inch—will gradually but surely take the place of the others, and already our customers are ordering largely under that system.

No form of gauge has hitherto been suggested which, for combined facility and accuracy in use, can equal the V-shaped gauge marked off in one-thousandths of an inch (See page 61 in our hand-book for a rough sketch of what we mean.)

When the most definite results are demanded, then the micrometer gauge, or something of that kind, must be brought into requisition, but that is only necessary for the finest work.

We ourselves, in ordering wire, refer, according to circumstances, to either of the three gauges first above referred to, or designate by fractions of an inch. We have already stated what was our practice in manufacturing—*i. e.*, that we used mainly our own gauge, or either of the others, or fractions of an inch, as indicated by our customers.

Our experience, up to the present time, would not lead us to recommend federal or state legislation enforcing any one gauge, and it is, perhaps, unnecessary to hasten by legislation the adoption of a gauge based upon fractions of an inch. If any legislation were to be encouraged, we should hope it would be confined to the latter.

WASHBURN & MOEN MFG. CO.,
WORCESTER, MASS. CHAS. F. WASHBURN, V.-P.

THE METROPOLITAN TELEPHONE AND TELEGRAPH COMPANY, NEW YORK.

To the Editor of The Electrical World:

SIR: Your letter of May 24 came duly to hand. I hope you will pardon the apparent negligence on my part in not replying earlier; a rush of work is one of the reasons for the delay. In purchasing wire, we give our orders in one thousandths of an inch or specify Brown & Sharpe's gauge. We are in favor of a standard gauge. In regard to legislation, think that is a question that should be settled by the electrical companies and manufacturers.

W. H. ECKERT, General Superintendent.
NEW YORK CITY.

PHILADELPHIA CITY ELECTRICAL DEPARTMENT.

To the Editor of The Electrical World:

SIR: In reply to your communication of May 24, I have to say that this department, in making contracts for wire, always requires B.W.G., and I am of the opinion that there should be a uniform gauge adopted by the makers, which I think could be easily done in a convention called for that purpose. D. R. WALKER,
PHILADELPHIA. Chief of Electrical Department.

Researches Upon the Self-Induction of an Electric Current.*

BY PROF. D. E. HUGHES, F. R. S.

Numerous researches have been made upon the self-induction of coils of wire, and but few in relation to the influence exerted by the nature and geometrical sectional form of the electrical conductor when employed in straight wires as in those of a telegraph line with the earth as a return, or those of a single wide loop where the distance of the return wire is sufficient to prevent any appreciable effect from the *mutual induction* of separate portions of the wire upon each other; our present theories class all non-magnetic metals together, taking only into account their specific resistance and the diameter of the wires; they admit, however, a certain modification in magnetic metals due to their magnetic permeability, but we have had but little experimental evidence of the effect produced.

The whole subject seemed to me worthy of experimental investigation, and I have lately† given the results of a first series of experiments made last year. I have remarked since writing that paper many new and important effects, and I have made a new series of researches, the results of which I wish particularly to point out in this paper.

In my late researches I made use of a modified "Wheatstone's bridge" together with a portion of my "induction balance," by means of which the induced or extra currents from the wire under observation were balanced by a secondary current induced from an independent circuit; this gave excellent results, but the method has been criticised as having the fault of not being clear in its indications. In order to meet this objection and also verify the results which I had previously obtained, I constructed an entirely new bridge founded upon a most simple and well-known principle, and as the bridge admits of no change in the relative resistance of its sides, its action can be easily understood; it is with this instrument that I have made my new series of experiments.

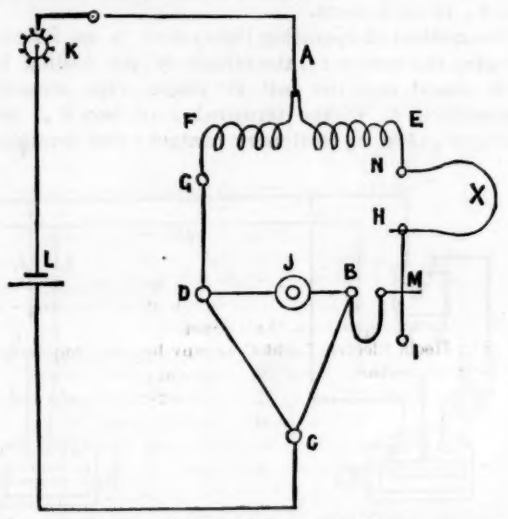


FIG. 1.—HUGHES' SELF-INDUCTION EXPERIMENTS.

The instrument consists of an ordinary Wheatstone's bridge, with the exception that a telephone replaces the galvanometer; there are in addition two coils of insulated copper wire, one in each portion of two sides of the bridge, by means of which the mutual self-induction of its convolutions can be increased or decreased as desired.

The electrical contacts are made either by a continuous periodic or tuning fork contact maker, or by a peculiar clockwork rheotome which I have made, in which a contact spring rests lightly on a wheel whose roughened surface is divided into eight equal parts of contact and insulation, by means of which we receive on the telephone eight equal periods of sound and silence each revolution of the wheel. We are by this means better enabled to appreciate feeble sounds than if they were continuous, and as the wheel can be made to revolve at any between two and ten revolutions per second, we have from 16 to 80 periods of silence between each rubbing contact per second.

The accompanying Fig. 1 shows the theoretical plan of the electrical communications of the bridge:

A, B, C, D are the four sides of the bridge, the telephone, *J* replacing the ordinary galvanometer; the sides *C B* and *C D* are formed of German silver wire, each 50 cm. in length, 0.5 mm. in diameter, and 0.85 ohm resistance; the sides *A B* and *A D* have also 0.85 ohm resistance, so that the four sides have equal resistance, and this remains a constant during the whole series of experiments.

A E and *A F* is a continuous spiral of copper wire, formed of hard copper silk-covered wire of 1 mm. diameter and 4.80 metres in length, wound loosely on a boxwood cylinder of 3.50 cm. diameter and 30 cm. in length, on which it moves freely; the entire helix has 40 turns of 4 cm. diameter, each spiral being separated 5 cm. from each other; the spiral, however, is separated into two equal portions by giving a greater separation at the centre, in order to allow it to be attached to a sliding collar of wood, by means of which we can press the spiral closer together on either side as desired; at *E* and *F* there are also adjustable collars of wood, and as the boxwood cylinder is graduated, we may (if the central collar is fixed) approach more or less either side of the helix, and read the degree of approximation of the coil, thus adjusting the mutual induction of each side to a perfect balance or zero. In practice I prefer moving the central collar, using the end collars only for the perfect adjustment of its zero, as we then have a double effect, viz., closing the coil, say, from *A* to *F*, increasing its mutual self-induction, and at the same time decreasing the previously balanced induction of the coil *A E*. This not only gives a wider range of effect, but renders the scale readings more uniform; the end *F* of the helix is joined to about 10 cm. of German silver wire, completing the circuit from *G* to *D*. This supplementary German silver wire is simply for the purpose of making the resistance of *A D* equal to *D C*, and its length should be adjusted to this purpose; the end of the helix *E* joins directly with the terminal *N;* the wire to be tested *X* is joined to *N* and *H;* from *H* to *I* there is a second supplementary German silver wire allowing us, by means of the contact side *M*, which is in direct communication with *B*, to introduce more or less of the German silver wire in the side *A B*. The resistance of the wire to be tested should always be less than that of the opposite side of the bridge, and we then make up the total resistance of *A B* by sliding the contact slide *M* until the resistance of *A B* equals *A D*.

It will be evident that in the whole series of experiments there can be no change in the resistance of either side whenever zero is found, the induction coils or balance having the same proportional current in all the changes of the wires under observation, the battery and telephone circuit present also a continuous absolute relation; we may, however, when desirable, keep the resistance from *H* to *M* a constant, and vary the resistance or the length of the German silver wire *G D*; we then balance the wire *X* by an equal resistance on the opposite side of the bridge, but then the battery and telephone circuits no longer possess the invariable relations which are so extremely necessary in experiments of the nature of which I have been making.

The battery circuit is joined in the usual manner to *A C*, the current can be interrupted by the rheotome *K*, or by means of a commutator (not shown in the diagram) close the battery circuit, and transfer the contact maker to the telephone circuit *B D;* this allows us to observe the effect of an intermittent current compared with that of a constant or steady flow. M. Gaugain has termed the period of a steady flow of current the *stable period*, and that in which a rise or fall of the current takes place the *variable period;* these terms have since been generally adopted by telegraph electricians, and in order to avoid introducing new terms, they will be used in this paper.

It would require too much space to enter into the details of the construction of the bridge; special care is required in the construction of the balancing induction coils, and in securing perfect electrical contact in all parts of the bridge; the induction balance requires calibration, and for this purpose I introduce as the wire, *X*, successive lengths of 10 cm 1 mm. diameter copper wire, thus forming a table of values throughout the range of the induction balance, or by equal increments of 10 cm. of copper wire up to 20 metres.

Having no unit of self-induction to which my results could be quickly and practically referred, I have adopted as unit the self-induction of a straight copper wire 1 mm. diameter and 1 metre in length; this gives on my calibrated induction scale 100 degrees, and it is to this standard that all the comparative force of extra currents mentioned in this paper is compared.

The self-induction of a wire is proportioned to its length, consequently a source of error might exist in the different lengths of the supplementary resistance wire, *H I*, introduced to balance the resistance of *G D*, but as we are enabled by the high specific resistance of German silver wire to obtain a very great change in resistance by a comparatively small movement of the sliding scale, this error in most cases of comparative experiments is but a fraction of 1 per cent., and when taken into account as it should be the error no longer exists.

The telephone used should be of the most perfect kind, and adjusted expressly for rapid and feeble sounds. I have found it best to employ an extremely soft Swedish iron diaphragm, without varnish or anything that can diminish or deaden the sound; its fundamental note should be higher than those generally in use, or at least 500 double vibrations per second, for we have to deal with extremely rapid effects which on short wires cannot be rendered evident upon a galvanometer, but which with a telephone in perfect adjustment are heard most distinctly with an electromotive force (?) in the battery circuit ranging from 0.001 to 0.250 ampère.

In the sketch of the communications the wire to be tested, *X*, is shown in the form of a wide loop, but in practice the instrument is constructed on two separate frames of wood articulated together at *D* by means of which we can separate the terminals, *N, H*, and introduce straight wires, sheets, or tubes of lengths varying from 5 cm. to 1 metre.

The object of my researches being to observe the self-induction which takes place in straight wires, or in those of a single wide loop where the reaction from any return

* Read at the Royal Society, May 27, 1886.

† "Self-Induction of an Electric Current in Relation to the Nature and Form of its Conductor." *Journal of the Society of Telegraph Engineers and Electricians*, January 28, 1886. ELECTRICAL WORLD, February and March.

wire is at such a distance that its influence is not appreciable, I shall, therefore, use the term self-induction to indicate the effects due to the electric current in its own portion of the wire, and mutual induction to indicate those where the reactions of different portions of the current and circuit react on each other, as in the case of coils; and although some theoreticians consider the two cases as the same, they are, as my experiments prove, entirely distinct, for we have, as will be shown, for copper wires a low co-efficient of self-induction with a high mutual induction, while in iron wires the reverse is the case, for we there have a high co-efficient of self-induction with an extremely feeble coefficient of mutual induction.

(TO BE CONTINUED.)

Meeting of the Electrical Section of the American Institute.

At the 83d meeting of the section, formerly the New York Electrical Society, held on June 24, Dr. Vander Weyde, the president, read a paper which gave in a concise form the history of the electric railway, from its inception to the present day.

Mr. J. M. Pendleton supplemented this by an account of the methods adopted to apply the storage battery for railway purposes, and described his plan of regulating the speed of motors by opposing the batteries upon the cars to the current from the line. This aroused some discussion, in which Messrs. C. O. Mailloux, G. W. Mansfield and others took part.

The meeting was well attended and was graced by the presence of several ladies.

Mr. Pendleton, in referring to the application of storage batteries to the propulsion of tram-cars, prefaced a statement as to his method of applying them by a few remarks regarding their origin and his connection with their exploitation in this country. Mr. Pendleton stated that he was the first manufacturer of the Faure storage battery in this country, and recalled the fact that in 1882 he read a paper on the subject before the Boston Society of Arts. He drew attention to the point that since that time their development has been prevented in this country by extensive litigations between the owners of the divided interests in the patent No. 252,002, which has now been settled by a consolidation known as the Electrical Accumulator Company of New York. This patent, No. 252,002, of C. A. Faure, consisted principally of the smearing of receptive material on a smooth lead plate or electrode.

The other United States accumulator patents of this inventor are three in number, covering the use of perforated lead plates with the receptive material contained in the perforations, and Mr. Pendleton said they embrace all the improvements in the arrangement and manufacture of the storage battery since 1881. These latter patents were purchased by Mr. Pendleton some time since from M. Faure.

Mr. Pendleton then gave a short account of the various attempts to employ electro-motors upon tram-cars, and detailed his own method of recent date. This consists of a car provided with an accumulator or storage-battery working on a line provided with fixed conductors, charged from a stationary source of electricity, the accumulators being charged while the motor is receiving current from the fixed conductors, and the energy thus stored is subsequently utilized to actuate the motor on extensions or parts of the line unprovided with charging conductors.

The latest invention of Mr. Pendleton, as described by him, relates to electrical self-propelling cars, operated on the above-described system, and has for its object to regulate and control the electromotor and compensate for the varying resistance of the charging-circuit between the motor-car and the stationary source of electricity as the car changes its position on the line, by altering the arrangement and combinations of the accumulator cells so that the electromotive force of the accumulator is caused to vary in such relation to the variations of resistance of the charging-circuit that an approximately uniform amount of electrical energy is supplied to and utilized in the motor at all parts of the line. A suitable switch is employed to variously arrange the elements or cells of the accumulator, which, while providing for the application of a constant amount of energy to the motor as the resistance of the charging-circuit varies, also provides means for regulating the speed of the motor on any part of the line by opposing to the electromotive force of the charging current varying electromotive forces from the accumulator. The total electromotive force of the accumulator when in series with the motor with its cells arranged in single series may even be such as to entirely oppose that of the charging source and cut off all current from the motor circuit.

The principle of this invention—the utilization of a variable electromotive force to compensate for varying resistance of an electric circuit, and to regulate the amount of energy supplied to electromotors—can be applied to any system in which electricity is used as a motive power.

Mr. Pendleton remarked that, heretofore, the regulation of electromotors to compensate for variations in the current supplied thereto has been accomplished by introducing varying dead-resistances into the circuit or shunting part of the current through varying resistances. Such excess of current acting on the included dead-resistances in the circuit or shunted is lost as useful energy by being dissipated in the form of heat. By the substitution of an accumulator or storage-battery for such dead-resistances the excess of current is preserved by causing chemical action in the accumulator, which, as stored energy, may be subsequently utilized in operating the electromotor. When applied to regulate the motor of a self-propelling car, this stored excess of energy is fully utilized as useful energy in actuating the motor, which may be done on any portion of the main line by completing the circuit of the motor with the accumulator; or the stored energy may be utilized in actuating the self-propelling cars on non-electric branch lines or extensions.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
June 28, 1886.

The parent Edison Company now has some fifty sub-companies, scattered all over the country. This branch of the business, having grown to such proportions, fully occupies the time and energies of the officers. The "isolated" branch, or, in other words, that for furnishing small plants, is to be conducted after July 1 by a new organization, to be styled the Edison United Manufacturing Company. The men interested are the heads of the various Edison manufacturing establishments. The new company takes the entire building, 65 Fifth avenue, so long the Edison headquarters, and proposes to renovate it thoroughly and refurnish handsomely throughout. There will be a fine showroom of fixtures, dynamos, motors and other appliances, so that a visitor can see without trouble or delay the whole Edison equipment for light or power plants.

The main floor will contain the offices and show rooms, with the various sizes of dynamos and cases containing the various appliances, cut-outs, lamps in all sizes and colors, switches in all sizes and numbers, test instruments, brackets, fixtures. Chandeliers, shades and globes in all styles of ornamentation and colored effects, reflectors, and many other details too various to mention, will adorn the apartments.

The other floors will be devoted to motive power for railroads, factories, mills, blowers, fans and other applications, some in active operation. The basement will be devoted to supplying the current for the exhibitions rooms above.

Mr. J. Hutchinson, who is known to every one from his prominent connection with the Edison Company since its formation, is General Manager and will have control of the business. The evolution of the Edison Company has been rapid, and each of the steps taken of this nature has been the result of necessity. Probably no other business in the country can be instanced as a parallel to the Edison, which from the first has had to work out its own problems, without any precedent to serve as guide, and now stands stronger than ever, in the full enjoyment of prosperity, unique in its methods, and thoroughly systematized in every department. The old parent company, which will have the control of business relating to all plants put in operation up to this date, will move to their financial quarters, Wall street.

The Hecla Electric Light Company has the following officers: President, Arthur Ingraham; Secretary and Treasurer, W. McC. Little; General Manager, R. Crawford; Electrician, C. T. Jackson. Since April 1, when the company settled down to business, five incandescent and eight arc dynamos have been installed, with 150 incandescent lamps and 25 arcs, in part as follows: Joseph Doelger, brewer, New York, 5 arc lights and one machine; George A. Mayo, Friendship, N. Y., 8 arcs and one machine; F. Malone, Fourteenth street, New York, 40 incandescents and one machine; Cook & Riley, 214 East Thirty-seventh street, 50 incandescents and two machines. Seven more plants are being put in by this company, of 40 arc lights, about 500 incandescents and 10 dynamos. Mr. George E. Adams, Glen Falls, N. Y., has, I hear, 20 incandescent lamps and one Hecla dynamo run by the Shipman engine. Mr. C. D. P. Gibson, the storage battery inventor and manufacturer, has also put in one of these dynamos, with Shipman engine, for the purpose of charging his batteries. Mr. E. L. Mitchell, Taunton, Mass., has been yet another customer, taking 20 incandescents and a machine. This is unquestionable activity, and I need only add, parenthetically, that the company are very well pleased with the results of their advertising in THE ELECTRICAL WORLD.

Noll Brothers, 65 Fifth avenue, the electrical engineers and Edison wiring contractors, are wiring Washington Park for one thousand 6 c. p. Edison lamps, to be placed in a floral display for the Arion Society. They are also putting in one thousand more colored 6 c. p. lamps to brighten the scene for the Liederkranz Society on the occasion of their annual society ball.

Mr. A. Livingston Bogart, whose thorough training as an electrical engineer has been gained by hard study in the principal schools of Germany and France, and in the workshops and business of his father, Mr. A. L. Bogart, has often been called from his own work to give some needed information to one or other of the employés. A little while ago, therefore, it was proposed to devote every Wednesday evening to a practical and theoretical lecture by young Mr. Bogart, on the use of electricity, going back to first principles and working up. The proposition met with a hearty response from the employés, who now attend the Wednesday evening sessions with great pleasure and profit. The plan thus pursued is highly creditable to all concerned.

Journaline oil is, I find, being highly recommended by engineers for electric lighting dynamos. Mr. W. P. Feeney, the manufacturer, claims for it that it is the only reliable oil for dynamo journal-bearings. His factory is at 14 Centre street, this city.

Charles H. Hinds, manufacturing electrician, of 418 West Twenty-seventh street, is the oldest maker in this country of frictional electrical machines for multiple gas lighting. He made the apparatus for the Rand Powder Company before they adopted the magneto. He is as busy and active as ever, and will give promptest attention to orders or requests for estimates on fitting up stores, etc., with his system.

The Splitdorf Insulated Wire Company manufactures under the patents of Mr. Henry Splitdorf, who has been engaged in this field for over twenty years, and has an experience covering all branches of spool-winding for electrical work of every description requiring magnets. His specialty is covering wire direct with cotton fibre, which makes an excellent insulation, and serves as an admirable substitute for silk. He has now removed from New York to new offices and factory, corner York and Washington streets, Brooklyn, where he has associated with him, as superintendent, Mr. E. R. Knowles, of the Brooklyn Electric Construction Company.

It will not be amiss, as indicative of the demand for belting, to mention a few of the plants recently equipped by Lawrence & Herkner: Six belts, 8 and 10 inches, 40 to 60 feet long, special oak tanned, for the electric lighting at St. George's, Staten Island; three for Bloomingdale Bros., New York City, 24 and 11 inches wide, for an Edison plant of 1,000 lights; two belts for Beadleston & Woerz, 8 inches wide, 45 feet long, for an Edison plant of 500 lights; six belts, 10 inches wide, 36 feet long, for the Trenton, N. J., Westinghouse central station of 1,500 lights; two belts for the Fort Hamilton Hotel, N. Y., 12 inches wide by 49 feet long, for Edison plant; two belts, 9 inches by 40 feet, for a 500-light Edison plant.

The Brush-Swan Company is putting in about 500 Swan lights for the New York Life Insurance Company. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., June 28, 1886.

At the Massachusetts State House, on Friday, June 25, the bill authorizing gas companies to furnish electric lights was referred to the Judiciary Committee.

The Ball Electric Light Company has sold a 30-light machine to the electric light company just being organized at Rochester, N. H.

Report is current that the S. C. Forsaith Machine Company, of Manchester, N. H., will soon transfer all right to the manufacture of the Whitney dynamo machine to a prominent manufacturing concern at St. Johnsbury, Vt. W. I. B.

HARTFORD, Conn., June 21, 1886.

The Bonsilate Box Company, No. 24 Mechanic street, this city, manufactures a fine line of insulating materials. For some time past this company has been busily engaged filling orders for several of the leading electric light manufacturing companies. The manufacturing facilities of this company having become overtaxed, preparations have begun for the enlargement of the factory and the addition of more machinery and help.

Mr. E. Ryder, the popular manager of the Hartford Western Union Telegraph office, is the inventor of an ingenious and useful device, which has been termed "The Electric Envelope Moistener and Sponge Cup." It will seal and stamp all sizes of envelopes without the application of the human tongue. For telegraph offices this device is especially adapted, and will prove itself an indispensable article. A postal to Messrs. Ryder & Co., Hartford, Conn., will elicit a catalogue and price-list.

The Hartford Steam Boiler Inspection and Insurance Company has largely increased its business with electric lighting enterprises since the opening of the present year. All boilers under the care of this company are carefully inspected from time to time by competent men, who, at the same visits, test the steam gauges, adjust and properly weight the safety valves, and carefully examine the boiler connections. The policy of insurance which this company issues covers damage to boilers, stock and machinery, also loss of life and accident to persons arising from explosions. The Boston *Commercial Bulletin*, of June 26, contains the following: "The Hartford Steam Boiler Inspection and Insurance Company has settled with the Troy Steel and Iron Company the loss by the boiler explosion at the Rensselaer rail mill June 7. The settlement included payments for the death of the three men fatally hurt, and for the wages lost by the other employés through the injuries they received. The settlement was at about $17,000."

The Brady electric light mast arm, for which Mr. H. M. Linnell, of Hartford, Conn., is the selling agent, is coming generally into use in the electric-lighting field. Among the advantages claimed for this mast arm are the following: It will support a weight of 250 lbs.; it can be lowered and raised in less than one minute; the lamp is so suspended that it can only be reached and operated by an employé; it is impossible for the lamp to fall, and it has superior advantages for throwing the light to a long distance.

At this date the Brady mast arm is being used in the following cities and towns, viz.: Troy, N. Y. (70); Kansas City, Mo. (25); Richmond, Va. (75); Brooklyn, N. Y. (22); Hartford, Conn. (20); San Francisco, Cal.; Paterson, N. J.; Mobile, Ala.; Baltimore, Md.; Wooster, Ohio; New Britain, Conn.; Middletown, Conn.; Danbury, Conn.; Holyoke, Mass.; Marlboro, Mass., and North Attleboro, Mass.

The plant of the Hartford Electric Light Company is in a prosperous condition, and the stockholders are elated. At present, 340 arc lights are in use, and steps are being taken to enlarge the lighting capacity of the plant to 500 arcs to enable the company to fill orders already assured at the beginning of the autumn months. The Thomson-Houston system is used. A dividend of 1½ per cent. was paid on June 22, being the regular quarterly dividend—the sixth in eighteen months.

The Waterbury Electric and Manufacturing Company of this city has made rapid and satisfactory progress during the past three months, and orders are now in hand for the installation of a number of arc-light plants to use the Waterhouse dynamos, lamps and other necessary apparatus.

During the preceding and present months, several prominent promoters of electrical enterprises have visited the factory of the Waterhouse Electric and Manufacturing Company, at Colt's West Armory, and they expressed a favorable opinion regarding the tests made with dynamos, lamps and other apparatus of the company's system.

A few words about this system, additional to what you have already said, may be of interest. A characteristic feature of the dynamo is that there is no destructive sparking at the commutators; it is a handsome machine, is easily handled, and runs smoothly, with very little noise. The company's No. 2 arc lamp has astonished and pleased everybody who has seen its remarkable performances, displaying great feeding powers, in conjunction with other merits. As an illustration of what it will do under an extreme test, an electrician broke off the lower carbon near the holder, and the upper carbon dropped gradually to an arc, burning as before the break, without a hiss; and another noticeable feature of the test was that while the experiment was being made, not the least disturbance to the other lights, then

burning, was discernible. The company invites correspondence relative to its system. Its illustrated catalogue will be forwarded on receipt of application. The officers of the company are as follows: Asa S. Cook, president and treasurer; Seth W. Bishop, vice-president; Chas. E. Chapin, secretary; A. G. Waterhouse, electrician.

The following is a partial list of the plants installed by the Mather Electric Company since April 1, 1886, viz.: A 300 incandescent light plant in the silk factory of R. & H. Simons, at Union Hill, N. J.; 125 incandescent plant, Winona Paper Mills, Holyoke, Mass.; 75 incandescent plant, Crane's Mills, Dalton, Mass.; 50 incandescent plant, Crane & Bros.' Mills, Westfield, Mass., and recently this company has fitted up two of the Starin Line steamboats with plants of 100 incandescent lights respectively. Mr. W. N. Gray, who has the company's Cincinnati office—Carlisle Building in that city—has the entire charge of the Ohio district, and reports the installation of incandescent light plants with the Mather Company's system since May 1, 1886, viz.: In the magnificent building of the *Commercial Gazette*, Cincinnati; Henck Opera House, Cincinnati; Henck Theatre, Cincinnati; Harding & Company's Paper Mill, Franklin, O., and in the Black & Clawson Mills, Hamilton, Ohio.

The factory and business offices of the Mather Electric Company are in Hartford, Conn., but the executive offices of the company are in North Manchester, Conn. The officers of the company are: H. G. Cheney, president; Robert Cheney, vice-president; P. H. Woodward, secretary and treasurer; N. T. Pulsifer, general manager; Thos. Pray, Jr., general superintendent.

The Schuyler Electric Light Company, of Hartford, the excellence of whose system is familiar to the majority of the readers of THE ELECTRICAL WORLD, is constantly kept busy filling orders for new arc and incandescent plants, or increase of equipment for those previously installed. The business manager, Mr. H. M. Linnell, courteously furnished your correspondent with the following data, which shows the remarkable push and prosperity of his company. At Wooster, O., the Schuyler Electric Light Company has received the contract for lighting the entire city for a period of three years, with the privilege of ten. At Canton, O., the company obtained a contract containing precisely the same terms and stipulations as those secured from Wooster. At Massillon, O., a contract for 60 arc lights was secured from the authorities, to be used for a period of three years, with privilege of ten. In addition to the city contracts, above set forth, the Schuyler Company has subscriptions for commercial lighting in both the cities of Wooster and Canton, O., respectively, 60 arc lights in the former and 100 arc lights in the latter. At Skowhegan, Me., the company has just completed the installation of 25 additional arc lights for street lighting. The authorities of the city of Richmond, Va., have appointed a committee to consider the advisability of increasing the number of electric lights of the Schuyler system now in use to three hundred; and to change the hours of lighting from six hours to the entire night. The Elizabeth, N. J., Electric Light Company has just increased its plant by an additional Schuyler machine, and has taken into its circuit the town of Elizabethport, N. J. North Attleboro, Mass., has secured a contract from the adjacent town of Attleboro for 45 arc lights for street lighting, and the plant will be equipped with the apparatus of the Schuyler Company. Mexico, Mo., Schuyler Electric Light Company has entirely rebuilt and re-equipped its station, which was recently burned out.

The parent company is continually adding new apparatus to its system—thus advancing its popularity and increasing its business. Its latest catalogue is a very attractive and interesting publication. The officers of the company for the present year are as follows: Geo. M. Bartholomew, president; Chas. E. Dustin, vice-president, treasurer and general manager; H. M. Linnell, business manager; Geo. H. Williamson, secretary.

Mr. Dwight Slate, manufacturer of machines and fine tools, has made and patented several improvements in single and three-spindle sensitive drills. These will be ready in quantities to suit the demand of the trade by the first week in July.

The Jewell Belting Company of this city, one of the pioneer enterprises in the belt-making industries in this country, continues to enjoy a good share of the business in this line tributary to the Eastern markets. The belting manufactured by this company has stood prominently before the public for excellence, durability and reasonable prices since the inauguration of the enterprise by Messrs. P. Jewell & Sons.

The Hartford Rubber Company (Messrs. J. S. Gray & Son, proprietors) makes as a leading specialty of its business the line of hard rubber goods for electrical and mechanical purposes, including rubber hook insulators, switch-handles, plug-handles, window and speaking tubes, together with a full line of sheet, rod and tube rubber.

Since the date of removal of the Eddy Electric Manufacturing Company from its old quarters on State street to its present quarters in the iron front building, opposite the Union Depot, its business has been steadily increasing. This company manufactures the Mather dynamo-electric machine for electroplating, electrotyping, copper-refining, etc., etc. Good judges have pronounced this machine unsurpassed in efficiency, simplicity, workmanship and general excellence. W. I. B.

WATERBURY, Conn., June 22, 1886.

The Plume & Atwood Manufacturing Company recently notified its large force that from and after a certain date (June 19) the works would close promptly every Saturday at five o'clock P. M. The employés will receive pay for ten hours just the same, and consequently are very grateful to the management for its liberality, particularly as they had made no demands for the concession.

The Connecticut Mutual Steam Boiler Inspection and Insurance Company is the name of a promising organization which has just been founded in this city. The purpose is to insure against all loss and damage to property arising from explosions in the use of steam boilers, including injuries to persons thereby. The certificate from the Insurance Commissioners has just been received, authorizing the issuance of policies. At a meeting June 12, at the Brass Association rooms, E. C. Lewis presiding and J. B. Spencer, secretary, by-laws were adopted and the following fifteen directors elected: D. S. Plume, D. B. Hamilton, J. R. Smith, F. J. Kingsbury, H. A. Matthews, S. H. Willard, R. E. Hitchcock, Henry S. Chase, Aaron Thomas, H. L. Wade, E. A. Saunders, Franklin Farrell, O. H. Stevens, F. H. La Forge and J. B. Spencer. Other signatures to the articles are E. C. Lewis, A. S. Chase, C. M. Platt, H. L. Wade, J. H. Bronson, J. S. Elton, Alfred Wells, E. S. Smith, C. R. Baldwin, O. H. Stevens, G. E. Terry, all of this city; G. A. Lewis, Naugatuck; and William Powe, Ansonia.

The Connecticut District Telegraph and Electric Company of this city is undoubtedly one of the most pushing and prosperous enterprises in the electric line in the State. In addition to its large facilities for manufacturing and handling a varied line of electrical goods and supplies, it is doing a large business in the way of equipping electric lighting plants and stations; and also wiring work for electric light companies. Recently it installed a 60 incandescent light (16 c. p.) plant for the Edison Company at the Hartford Carpet Factory, Thompsonville, Conn., putting in the entire equipment and doing all the wiring work.

Mr. Alden M. Young, of Waterbury, has been for many years identified with several electric lighting enterprises, which owe to him—to a considerable extent—their present standing and prosperity. Mr. Young has just closed a contract with the Norwich (Conn.) Electric Light Company to enlarge its steam plant, adding a 150 horse-power boiler and a 75 horse-power high-speed engine. That company is increasing its lighting capacity from 150 to 300 incandescent lights. It is using the new incandescent system of the Thomson-Houston Electric Company. Mr. Young is largely interested in the new electric lighting enterprise about to be started at Bristol, Conn. Work has already been commenced on the plant, and subscriptions have been booked for 60 arc lights and 100 incandescents of the Thomson-Houston system.

A controlling interest in the Poughkeepsie, N. Y., Electric Light and Power Company was recently purchased by a number of Connecticut business men, some of whom are of the wealthiest and most enterprising residents of Waterbury. The plant has been thoroughly renovated and re-equipped, and now consists of 271 arc lights of the Thomson-Houston system and 50 arc lights of the Fuller-Wood system, two 50 h. p. Armington & Sims engines, two of the New York Safety Steam and Power Company's engines, one of 100 h. p. and the other of 60 h. p., and two 120 h. p. boilers. Mr. M. J. Daly, of Waterbury, Conn., installed and equipped the steam plant, said to be a most complete and creditable piece of work. An interesting fact connected with the re-equipping of the above plant is that the work was begun May 5, and in less than thirty days the entire new equipment was in proper position, including many new poles and new circuits in various parts of the city, and lights were burning satisfactorily on the night of June 1.

Friday, June 25, will be a great day for the employés at Holmes, Booth & Haydens'. The new and handsome building designed for an office and commodious store-rooms will be surrendered to the men by the company, and will be dedicated in the evening with a ball and banquet. The invitation committee is composed of S. W. Chapman, C. S. Lewis and Ralph J. Shipley, and if there is a proper response to the invitations (and of course there will be) the company will be a very large one. The reception committee is Alexander Limont, Robert Barker and Nicholas Jenkins. Amphion orchestra will furnish music and will give a concert from 8 to 9. Uffendale will prompt. James Stout will cater for the banquet. Ralph J. Shipley is decorating the two stories where the dedicatory fun is to concentrate, and the place will present a most inviting appearance. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, June 28, 1886.

The ordinance regulating the laying and construction of underground wires, electrical conductors, cables and tubes was, after all its vicissitudes, passed finally on Thursday last. But more than half the available time for underground work this year has elapsed, and it is safe to say that a thorough and effective system of subterranean telegraphy is about as far off as ever. The delay is no fault of the various companies, but of the collection of politicians known as "City Councils." This can be proved by the fact that two companies are still waiting for permission to put their wires under ground, and are liable to wait for some time. They are the American Telegraph and Telephone Company and the Baltimore & Ohio Telegraph Company. The ordinances granting these companies permission to put their wires under ground were sent to the electrical committee over a month ago, and although three meetings were called to consider them, it has been impossible to obtain a quorum at any of the meetings. On Thursday last the absence of one man prevented a quorum and the subject goes over for the summer season. The absent member was William A. Miller, of the First Ward, who is the batteryman for the Philadelphia Local Telegraph Company, which is controlled by the Western Union. Miller, as a batteryman, is appropriately situated, but as the representative of Jay Gould in the Philadelphia City Councils, he might be called a roaring farce.

Before closing up for the summer, Councils passed two other bills—one granting the Keystone Electric Light and Power Company permission to light a few streets in the central part of the city by electricity conveyed under ground, which was thought to be a necessity, and another permitting the Electric Pneumatic Transit Company to lay tubes under certain streets for the purpose of transmitting messages.

In accordance with the legal decision of last week, the Western Union has commenced to remove the "tickers" from the bucket-shops here. The movement to deprive the bucket-shops of quotations obtained from their board-room and furnished by the "tickers" was begun by the Philadelphia Stock Exchange several months ago. The Exchange ordered the Philadelphia Local Telegraph Company to remove their tickers from all bucket-shops, under penalty of being shut out of the Exchange. The telegraph company proceeded to obey the order, but several of the bucket-shops procured temporary injunctions and continued to do business. The hearings in these injunctions have been finished, and the first of the decisions in the cases was rendered by Judge Allison, who held that the Local Telegraph Company has the right to remove the ticker from the office of William Bouldin, in the Continental Hotel. The ticker men say they can as well get the quotations direct from New York, and that their business will go on just the same.

People in Chicago, San Francisco and other cities where there may be traction roads—street cars propelled by an endless rope revolving around a drum at the central station, running underground in iron conduits and by means of a "grip" attached to each car, dragging along all the cars that the company may choose to put on—will be interested in our new electrical alarm for such roads. Heretofore, when an obstruction has been discovered ahead of a moving car, the gripman (driver) has generally discovered at the same time that his "grip" would not let go the traveling cable, and so his car swept on like the Pontic Sea. Leaden tubes containing telegraph wires are now being fastened to the side of the large conduit in the street through which the cable passes. In each manhole along the route of the cable cars is to be placed a box containing electrical apparatus and a handle which any of the car conductors can operate. The appliance is described as simple and easy of management. If, as in a number of instances heretofore, the cable cars stop, or if the gripman should be unable to release his hold upon the cable rope, or if any other accident necessitating the stoppage of the cable should occur, the conductor, by lifting the manhole cover at any intersection, can pull the handle of the box and have the engine at the Twentieth street station stopped. When the handle of the box is pulled, the alarm will be rung at the engine-house, the number of taps representing the number of the manhole from which the alarm comes. As soon as the alarm is given, the signal "E" or "W.," indicating the eastern or western end of the road, will also drop near the alarm gong, so that information as to the exact locality will be instantly conveyed. The understanding is that the engine is to stop upon the first stroke of the alarm, so that if it happens that the grip becomes fastened to the cable the latter can be checked before any damage is done. A messenger, dispatched from the station to the point where the trouble is, can then communicate with the station from the box in the manhole by a code of signals, and order the engine started if the trouble has been overcome.

An editorial paragraph in THE ELECTRICAL WORLD, of last Saturday, on electricity in medical treatment, was particularly interesting here, as we were just finishing a trial in Court of an alleged electrical doctor. "Professor" William C. Wilson advertised extensively and sold his "Actina," which he claimed to be a panacea for all complaints. It was claimed to be a sort of an electrical machine or battery that Wilson sold for $10 each, and the disputed point was, whether he simply sold them or operated with them, which latter would have been construed as practicing medicine. The "battery," judged by the voluminous testimony, seemed to be exceedingly strong, but whether it was electricity, pure and simple, or oil of mustard, or horse-radish and onions, or wintergreen and belladonna, none of the practicing physicians could tell. The jury—poor fellows!—disagreed, and a new jury will have to sniff at the onions, horse-radish and mustard, and determine whether the result is an electrical shock or "Actina." It will be hard to tell.

The "Electrical Department"—a new name given to the old Police and Fire Department of the city government—will soon move into its quarters in the new City Hall. You have already given many details, but I may as well bring the information down to date. The apartment that is to be called the "operating room" is on the third main floor in the middle of the eastern side of the building, and fronts on Market street. It is 51 feet long and 46 feet wide, while the walls have a height of 30 feet. The room is approached from the corridor, which extends along the wing from north to south, by two entrances, the one at the southern end leading into a little compartment intended for the public, and divided off from the rest of the operating room by an ash railing and partition. This inclosure is provided with a desk for the convenience of those who may desire to do any writing. The oaken doorway in the middle is to be used only as a private entrance. In the northwest corner of the room is the sleeping apartment for the operators, which is inclosed on the east by a screen made of ash panelings, surmounted by panes of clouded glass. The southern partition is composed of a number of closets built closely together and having panels of cherry wood.

In the centre of the operating room have been placed three long tables, lying parallel to one another. These are to be known respectively as the relay, register and repeaters' tables. Running along a portion of the southern wall is the desk for the operators, but there are also several other desks in the room. The furniture is made either of ash, cherry or mahogany, and, as the department is well lighted, the general effect is extremely bright. The walls and ceiling are of white plaster, and the floors are yellow pine boards. On either side of the operating room is a chamber 46 feet in length and 10 feet in width, with a ceiling 16 feet high. The intention is to fit these two rooms up for the Chief of the Electrical Department and his manager. The southern room will be occupied by the chief, etc. The manager's apartment on the north will have a large case at one end for the holding of instruments and stationery.

The wires to be used in connection with the department will be conveyed through a tunnel from Filbert and Juniper streets to an opening in the foundation wall of City Hall, thence being carried up to a duct under the floor of the operating room. They will be connected with the battery room above by means of a vertical duct in the wall, to which they will run from a switchboard in the operating room. The floors above the operating office are taken up by the store and battery rooms, the latter being above the others. The storeroom has no windows, but will be lighted from the corridor along which it runs.

The battery room, however, is provided with six small and one large central window. It has a length of 78 feet and a width of 46 feet, and its most important feature consists of rows of oaken battery frames properly insulated. Upon these frames can be placed 1,500 cells, 50 upon each stand. The cells will rest upon porcelain drip cups. The room is furnished with steam-pipe radiators, and arrangements are made for a proper supply of hot water. The tanks from which the water will be procured are to be put up opposite the battery room.

The electric light is now used nightly on Broad street north of Columbia avenue, the wires running through an underground conduit and the lights being suspended on slender iron poles. The effect is very fine.

The lightning played havoc with the city telegraph wires in the vicinity of Belmont and Elm avenues last Friday evening. The box in the Police Patrol Station at that point was torn from its fastenings and thrown against the iron door, which it forced open, falling in the street ten feet distant. The woodwork of the box was splintered, and of the ground wire, four feet long, only an inch remained intact. The same lightning stroke passed over a tele-

phone wire and into the Chestnut and Walnut streets Passenger Railway depots at Belmont avenue and Jefferson street, and tore a hole through the partition wall large enough to drive a team through. The Receiver of the company states that he does not know whether he was knocked down or fell from his seat, but he felt the shock and found himself on the floor. Three telegraph poles in the same locality were shattered.

Gas versus electric lighting is still agitating Atlantic City—the Coney Island of Philadelphia. At that place, since the local electric light company have put in a large number of incandescents in the hotels and business houses, there has sprung up an interesting rivalry between the Gas Light Company, which is composed largely of Philadelphia capitalists, and the Edison Company, which is somewhat local in its composition. The electric light people are now placing their plant in position near the old West Jersey depot, and at the same time the Gas Light Company are making experiments with the hydrogen incandescent gas and burner at the Girard House, which is nightly illuminated with this invention. Mr. John Roberts brought the patentee over from Germany, where the light is extensively used, and the experiments are being made under his supervision. The results so far have not been satisfactory. The illumination is not as good as was expected, nor has it reached the pure whiteness which is the main feature of the hydrogen incandescent. This, however, is easily explained, for the hydrogen gas is being flowed through old pipes and old fixtures. This is to be remedied.

All concerned now feel that there is to be a lively race on the light question in the near future. The Gas Company claim they can give 1,000 cubic feet of hydrogen gas for $1, and that the light will be better and steadier than the electric. In the meanwhile Atlantic City folks are watching and waiting, ready to pay their money and take their choice.

Frank S. Mann, of Lewisburg, who has received the contract to run the wires of the electric light company for the incandescent system, has arrived in Reading, Pa. James Lyman, representing Edison's electric works, New York, is also in the city, and will have general supervision of the works, which will be commenced this week.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, June 26, 1886.

When in St. Paul the other day with the Railway Telegraph Superintendents, I took a look around that thriving city on a tour of inspection of things electrical.

St. Paul has a good many electric lights, arc and incandescent, for a town of its size. The St. Paul Gas Light Company is the largest furnisher of arc lights. Gen. H H. Sibley is the president of this company; N. W. Kitson, vice-president; A. J. Goodrich, secretary and treasurer; Russell Baker, superintendent and electrician; W. E. Snow, night electrician; Thomas Cline, engineer. The company's station, a solid, two-story stone structure, 125 by 40, is at the corner of Washington and Eagle streets. The station has in place nine 25-light, one 50-light and four 10-light Fuller dynamos, giving the installation a capacity of 315 arc lights. Three engines, one a Harris-Corliss, one a Buckeye and one a Syracuse straight line, furnish the power. At the time of my visit they were actually running about an even 200 lights nightly. The rates received are 60 cents per night for lamps running until 12 o'clock, and 50 cents for 10 o'clock lights. Eighteen of the lights furnished are on three towers. The company is under no expense for fuel, not even the expense of hauling, as it uses horse manure delivered free at the station by the street car company. It manufactures its own machines, having the exclusive right from the parent company to manufacture, sell and repair the Fuller apparatus in and for Minnesota, Dakota, Michigan and Wisconsin. Besides the lights mentioned above, the company has several isolated installations in operation in its territory.

The St. Paul Electric Light and Power Company, J. H. Woolsey, secretary, and A. W. Morrell, electrician, has its offices at 13 Gilfillan Block and its station in the basement of the same building. Mr. Woolsey is the agent for the United States Electric Lighting Company. Sixty arc and 200 incandescent lights are furnished from the station. In St. Paul and surrounding territory Mr. Woolsey has placed some two thousand United States incandescent lights and a number of arc isolated plants. The Ryan House installation of incandescent lights is worthy of special mention. There are here 101 large mogul lamps of 125 c. p., and 320 of 16 c. p. There are 400 United States incandescents in the Opera House. In the flouring mills and elevators, including Minneapolis in the estimate, there are some 700 United States incandescents. Mr. Woolsey has some 96 arc lights in isolated plants.

Besides the arc lights already mentioned, there are probably fifty more scattered about in isolated plants, so that St. Paul was supporting, at the time of my visit, close upon 400 arc lights, and the plants in the city have altogether a capacity exceeding 500 arc lights—very good for a city of a little over a hundred thousand population.

Mr. C. C. Miles, 385 Jackson street, is a well-known dealer in electric bells, burglar alarms, gas lighting apparatus, annunciators, etc., and he has probably done more in this particular line in St. Paul than any other one firm. He always aims to give good and satisfactory work at reasonable prices. Mr. Miles is also a dealer in safes, and does a locksmithing business.

The St. Paul Exchange of the Erie Telegraph and Telephone Company is at 53 East Third street, P. Yensen, manager. Although this is an exchange of some 800 subscribers it is equipped in rather a primitive manner and is still using the old Western Electric standard switch-boards. The exchange exhibits a very healthy growth, however, and is at present adding the names of about 30 subscribers a month to its books; 18 operators are employed. There are 10 toll lines between St. Paul and Minneapolis. Mr. Chas. Jopling is the inspector.

The St. Paul District Telegraph Company is at 114 E Fourth street. The officers are C. Livingston, president; C. Gortzman, vice-president; E. H. Bailey, secretary and treasurer; H. Leveridge, general manager.

The Telford and Wendel Electric Supply Company is at 100 West Third street. They are engaged in the furnishing of electric supplies, including electro-medical batteries, burglar alarms, annunciators, etc. They also do a repair and model making business.

In Minneapolis the Minnesota Brush Electric Company does practically all the arc lighting. It has a large and handsome station, where there are in place nine 65-light Brush machines and one 16-lighter. Its station is 60 × 140 feet, and contains three Corliss engines. The plant has a capacity of 600 arc lights, and it is now running 500 lamps nightly. These are just about evenly divided between public and private lights, 250 of this number being city lights furnished to the municipality in accordance with the company's two years' contract, and the remaining 250 being furnished to private customers. The company's published schedule of rates is as follows:

	Cents.
Lamps on commercial circuit, each, per night	60
" " 12:15 o'clock " " "	75
" " all night " " "	90

A discount is allowed on all bills paid by the 10th of each month. The offices of the Brush Company are at 9 and 11 Washington avenue, north. Anthony Kelly is president; A. B. Barton, vice-president and treasurer; T. S. King, secretary and manager. The company has exclusive control of the Brush-Swan patents for the State of Minnesota.

There are 75 Brush arc lights in the West Hotel, 175 Brush-Swan incandescent lights in the Nicollet House, 260 Brush-Swan lights in the City Hall and 75 in the Palisade Mill.

The Minneapolis Union Depot has a Fuller plant of 20 or 25 lights.

The Minneapolis Electric Supply Company, T. S. King, manager, are general dealers in electrical supplies. They have a novel form of insulator which will shortly be placed on the market. The offices of the company are at 9 Washington avenue North, Room 4.

The Municipal Electric Lighting and Construction Company (W. A. Sheldon and A. S. Huey) have their offices at No. 10 Fifth street, North. They are contractors for wiring buildings of every description for electric lighting, agents for the Edison electric light, also agents for the Hess system of guest call and fire alarm for hotels, Standard Electrical Works gravity drop annunciator, and other electrical apparatus. This firm have already wired the buildings mentioned below, and furnished the following number of Edison lights in each case:

Minnesota Loan & Trust Company's Building wired for 450 lights; 250 burning. Collom Block wired for 460 lights. Monroe Block wired for 160; 80 burning. The Lumber Exchange wired for 700; 300 burning. Gates Bros.' block of eighteen dwellings wired for 316; 150 burning. Ardmore Hotel wired for 180. Temple Court wired for 675. College Hospital wired for 125. H. F. Lillibridge & Co. wired for 160; 120 burning. Newman, Warner & Elfelt Paper Mill wired for 95; 80 burning. Pittsburgh Flouring Mills are supplied with 750 lights. North Decatur Hospital for Insane, Jamestown, Dak., wired for 140; 120 burning. Northern Pacific R. R. Shops, Lake Como, wired for 525; 450 burning. Lindeker, Warner & Schurmier, St. Paul, wired for 125; 90 burning. Noyes Bros. & Cutler, St. Paul, wired for 110; 90 burning, and many others. I noticed a very handsome annunciator in the West Hotel, put in by this company.

The Minneapolis Electric Company, Mr. J. Hedden, manager, do a general electric supply and construction business. Their store and office is at 27 S. Fourth street.

Mr. Vernon Bell, electrical engineer, has lately moved into the Builders' Exchange, 17 Fourth street, South.

While in Minneapolis I had the pleasure of riding on a train of cars drawn by the new Van Depoele electric motor. This train runs on a section of the Minneapolis, Lyndale & Minnetonka R. R., carrying passengers from the city terminus of the road to the point where it meets the steam train. The train on which I rode was composed of three cars and the motor car. The cars were open, weighing about 13,000 pounds each, and heavily loaded. The class of cars used on the line, which the motor has frequently drawn heavily loaded in trains of two and three, weigh 13 tons each. In fact, they are New York Elevated Railroad cars. Five and six of the open cars can be easily drawn, notwithstanding the fact that the cars are heavily loaded, the traffic on the line being very heavy. The electric train has been running successfully from the beginning, and the railway people are said to be well satisfied with its performance.

Leaving St. Paul and coming to Chicago, I may note that the Electrical Supply Company, Chicago, has secured the western agency for Day's kerite wire for electric light purpose. A stock will be kept on hand here.

The new fire-alarm box of the Railway Telegraph Supply Company, Chicago, is meeting with an exceedingly favorable reception, and Manager Knapp reports the sale of several large fire-alarm equipments. The box is simple, durable and cheap, and is bound to be popular. The company finds trade good in all departments.

The agency scheme for operating telephones in Indianapolis seems to have settled the difficulty there for the present at least. Down at Lafayette, Ind., it is reported to me, they have rejected the agency plan. They will know more when they have tried it awhile without telephones.

The Union Electric Company of Chicago, incorporated by W. F Stewart, A. T. Rice and C. W. Blattner, has a capital stock of $250,000.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes the following stock quotations:

	W. A. K.
Bell of Mo.	$147@$150
Chicago	350@ 360
Central Union	45@ 47
Colorado	18@ 20
Cumberland	65@ 70
Great Southern	29@ 30
Great Southern Scrip, 90 cents on the dollar.	
Iowa Union	15@ 18
Michigan	63@ 65
Mo. & Kan.	54@ 56
Mo. & Kan. Scrip, 55 cents on the dollar.	
Rocky Mountain Bell	40@ 45
United	15@ 17
Wisconsin	103@ 105

THE TELEGRAPH.

T. M. B. A.—The Association having already passed one assessment this year, is now able to pass that for July as well. Notice to this effect has been sent to all the members.

The Two Million Suit is still going on. The Western Union Company has been putting in evidence to prove its good faith in cutting the Farnsworth wires, under warrant of the Dono-hue order, and has also sought to minimise by expert testimony the value put on the damaged property. Gen. Eckert has been on the stand giving his version of the memorable wire-cutting at 187 Broadway that Saturday afternoon last summer. It was elicited from Mr. Brown, superintendent of the Mutual Union, that Mr. Jay Gould had lately been discussing with him the value of the Bankers & Merchants' property.

French and English Facilities.—The French Postmaster General has under consideration a plan which will enable telegrams to be dispatched any hour of the night throughout France. Strange as it may appear, some of the most important provincial centres in England are absolutely cut off from telegraphic communication for twelve hours out of the twenty-four. Few people would credit, for instance, that at Woolwich, England's only arsenal, the telegraph office closes at 10 o'clock. Baron Wolverton is being urged to adopt the proposed French plan and keep the telegraph offices at Woolwich and at the more important towns open all night.

Associated Press Operators' Pay.—The telegraphers connected with the Western Associated Press have made a demand for an increased salary on the leased wires of the association. What they want is an increase of 5 per cent. on their present salaries. They are now required to work on Sundays, and have incorporated in their demand a request to have one day in the seven to themselves. The demand has been sent in to the officers of the Western Associated Press, and is made by 150 operators scattered all through the Western cities, from New Orleans north and Pittsburgh west. The demand is not made under any supervision of the Brotherhood of Telegraphers, nor as an Assembly of Knights of Labor. It is simply up to date a demand of this class of Associated Press telegraphers by themselves.

THE TELEPHONE.

Brazil.—The Companhia Uniao Telephonica do Brazil, of Rio de Janeiro, the new consolidated telephone company, has declared a dividend of 5 milreis per share. This is a sub-company of the Tropical Company. From the above it would appear that foreign telephone companies are beginning to get into a dividend-paying condition.

Rates for New York Residences.—The Metropolitan Telephone and Telegraph Company will give service after July 1 to private residences in districts reached by its wires for $100 a year; where offices and residences are in the same building, the old rate of $150 a year. Where more than one instrument is put on a circuit wire, only $75 will be charged.

The Inter-Continental Telephone Company, operating in Venezuela and having a capital of $200,000, has earned during the first five months of 1886 over $7,500 net. The net earnings for 1885 were nearly $18,000 over and above all expenses and construction, and will doubtless reach $24,000 net this year. Dividends are paid on the preferred shares.

Refusal to Reconsider.—A debate occurred in the Massachusetts Senate on the motion to reconsider the vote whereby the Senate passed to be engrossed the bill placing telegraph and telephone corporations under State supervision and inspection, Messrs. Lilley, Norris, Forbes, Morse and Milliken participated. The Senate refused to reconsider by a vote of 13 to 17.

Long-Distance Telephone Stock.—It is stated that Mr. W. D. Miles, one of Wall street's best-known brokers, is selling his seat on the Stock Exchange. His reverses are reported to be due to his interest in a long-distance telephone company organized some time ago, but which did not quite come up to expectation in its results. It is also reported that Mr. Miles has as fellow-sufferers many other gentlemen who were induced to invest in the stock.

Cottage City, Mass.—The government has ordered a telephone line to be built from Cottage City to Gay Head, an exceedingly important addition to the line when one calls to mind the dreadful disaster of the "City of Columbus," occurring twenty miles from the nearest civilization. Lieut. Thomas M. Woodruff, the efficient officer who superintended the laying of the signal service cable, has been ordered there to direct the construction of the line.

The Tropical American Telephone Company (limited), which has paid three dividends of ten cents per share semi-annually, will probably pass its July dividend. Although it has money in its treasury, the business of the last six months has been lighter than usual, and hardly justifies the regular division of earnings. No definite official action has been taken, however, on the subject.

The Newark Fight.—A final decree in the long contest between the Domestic Company, of Newark, N. J., and the Metropolitan and New Jersey companies has been filed in the Court of Chancery of New Jersey, in favor of the Domestic on new terms of the old contract, ordering a perpetual injunction to issue against the defendant companies restraining them from any interference with the Domestic business, and ordering that the defendants pay to the complainants the costs of the suit, to be taxed. The new license of the Domestic runs five years from Sept. 1, 1884.

Evansville, Ind.—At the last meeting of the City Council, a lively time was had over the question of rescinding the order to take down the telephone poles and wires from the streets. Mr. N. M. Booth made an effort to get a hearing in behalf of the lines, but was refused. Certain interrogatories are to be submitted to the Cumberland Company regarding its willingness to do certain things in return for certain concessions. Among other exactions, the city wants 3 per cent. of the gross receipts and fifteen "deadhead" telephones. Over 140 subscribers petitioned the city in favor of the company, and hence the proceedings.

Suing the Wallace.—The American Bell Telephone Company has filed a bill of complaint, and asked for an injunction in the United States Circuit Court here, against the Wallace Electric Telephone Manufacturing Company, to restrain them from manufacturing, using and selling electric speaking telephones, constructed and adapted for the transmission of articulate speech by the method claimed in the Bell patent. The defendants demurred to the bill of complaint as regards the validity of the Bell patents; also that the bill did not show by what devices the supposed infringement was committed. Judge Wallace has overruled

the demurrers, and ordered the defendants to put in their answer by August 1.

Output of Bell Instruments.—The output of instruments of the Bell company for the month ending June 20 and season to date were :

Month.	1886.	1885.	Increase.
Gross output	4,581	3,826	755
Returned	1,216	1,415	*199
Net output	3,365	2,411	954
Since Dec. 20.			
Gross output	21,635	18,148	3,487
Returned	9,262	12,436	*3,174
Net	12,373	5,712	6,661

* Decrease.

Government Monopoly of the Telephone in Spain.—The advisability of continuing the telephone system in Spain under Government control is reported to be under the consideration of the Minister of the Interior. About two years ago Señor Robledo, who was then Minister of the Interior, on the pretext that it would be dangerous to allow the telephone service to be in the hands of a private company, monopolized it for the State. Two years of an expensive service for the public has resulted in a proposal to abandon the system ; but, according to *El Dia*, the proposal is to grant a concession to a private individual, which, it is argued, would not result in any increased advantage to the public. It is urged that the telephonic service should be thrown open to the public free of privileges of any description.

THE ELECTRIC LIGHT.

Cedar Falls, Ia., is promised an electric light plant by Mr. S. B. Humbert and Mr. F. O. Jackson.

The White Star Steamer "Celtic" has now been completely equipped with electric lights and bells.

Phillipsburgh, N. J., is to have its streets lighted by electricity. Mr. W. E. Irwine may be addressed on the subject.

Monongahela City, Pa., has an electric light company with a capital stock of $10,000. Mr. J. M. Grable is the Treasurer.

The Tremont Electric Lighting Company, of Kittery, Me., is announced, with a capital stock of $300,000. The president is Mr. W. Rotch.

Revere Beach, Mass., will have this season at the Point of Pines sixty arc lights, an increase of thirty. New engine and boiler have already been put in.

Des Moines, Ia.—The capital stock of the Thomson-Houston Company, of the above city, is $50,000. Mr. J. C. Regan is the President, and Mr. P. G. Regan, Secretary.

Carrollton, Mo.—The Carrollton Electric Light Company has been incorporated with a capital stock of $7,000 by C. A. Scott, J. S. Wilcoxson, H. M. Pettit, C. W. Trotter and R. B. Minnis.

Manchester, N. H.—The Manchester Electric Light Company has decided to move its station from its present locality to one where it will have more room. It will put in a new tubular boiler made by the Whittier Machine Company, of Boston. The boiler will be set with the Jarvis patent boiler setting. This is the second order for the furnace. The contract for moving the old boiler and Armington & Sims Company engines, also for setting the new boiler, has been given to the Jarvis Engineering Company, of Boston.

The Electric Light in Hospitals.—A fresh proof of the growing popularity of the electric light in Paris is to be found in the fact that some interesting experiments are just now being made to light the hospitals there by electricity. A few of these institutions have already been furnished with an installation of incandescent lamps, not only in the operating theatres but in the sick wards, with such satisfactory results from a hygienic point of view that there is little doubt that before long the system will be generally adopted by the Administration de l'Assistance publique.

Ready for a Competitive Test.—The Ball Electric Light Company, of Canada, on behalf of the Ball Electric Light Company, of New York, has challenged the Royal Electric Company, of Canada, to a competitive test of the Ball and the Thomson-Houston system, $1,000 to be put up by each party. The Royal Company has declined the invitation, which arose out of the intention of the city of London, Ont., to use arc lights on the streets. It is stated that the London Aldermen have now called for a scientific test. The local papers to hand are full of the subject, and public interest has been excited now for over a month.

The Edison Plant at Rochester, N. Y.—The contract for the engines for the Edison Central Station at Rochester has been given to the Armington & Sims Company. The boilers will be made by the Woodbury Engine Company, of Rochester, N. Y. They will be of tubular pattern, six in number, each boiler will be 66 inches in diameter by 16 feet long, rated 100-horse power each. They will be set with the Jarvis patent boiler furnace and use Sheffield grates. The fuel will be anthracite coal screenings, as it can be purchased for 50 cents a ton in Rochester. The Edison Company, of Harrisburg, Penn., use the Jarvis system to burn this class of fuel, and it is one of the most profitable and best paying Edison company stations in the country.

The Electric Light in Shipbuilding.—A very happy and novel application of the electric light has been successfully effected in the shipbuilding yards of L'Orient. Hitherto the interior of vessels during their construction has been in a state of almost complete darkness, the employés having to ply their various crafts by means of candlelight, a condition of things which left much to be desired in point of illumination. At the request of the engineers of naval constructions, MM. Sautter, Lemonnier & Co. have just executed an installation of electric incandescent lamps, which can be moved about from place to place at will, just as candles, but of course being of infinitely greater illuminating power. The experiment has given the greatest satisfaction to the workmen.

American Electric Manufacturing Company.—The regular annual meeting of the American Electric Manufacturing Company was held at the offices, 146 Broadway, on Tuesday last. Election was made of the following board for the coming year : President and General Manager, Edwards H. Goff ; Vice-President, L. M. Bates ; Secretary and Treasurer, Henry E. Irvine ; Manager Incandescent Department, W. J. Jenks ; Trustees, Hon. H. S. Hyde, of Springfield, Mass. ; H. P. Frost, of New Haven ; Col. Silas Gurney, of Boston ; Charles B. Whiting, of Worcester ; Hon. L. M. Bates, A. B. Chandler, Rowland N. Hazard, Henry F. Gillig, Hon. John J. Kiernan, Henry C. Adams, Edwards H. Goff, and W. J. Jenks, of New York ; Executive Committee, L. M. Bates, H E. Irvine, R. N. Hazard, E. H. Goff, H. C. Adams. The prospects for a year of activity are most encouraging, it being shown by the report of the Secretary that orders are now on the books aggregating over one thousand lamps.

APLICATIONS OF POWER.

A Road for Niagara.—The Niagara Falls & Whirlpool Company is now making preparations to build a railway, from a point as near the foot of the inclined railway as possible, to a point just below the whirlpool, a distance of nearly three miles. It is proposed to use electricity as a motive power, the generating dynamo to be driven by turbine. The capital stock of the company, $100,000, has all been taken up. The road will give a magnificent view of the scenery. Fares will be not over 10 cents a mile, or 50 cents for the round trip. Mr. B. Fenton and Mr. E. Bennett, of Buffalo, are prominently interested in the road.

Ryde Electric Railway, England.—At the annual meeting of the shareholders of the Ryde Pier Company, the directors reported that the above project had been finished at an entire cost of $6,500. The increased traffic and small working expenses justified them in congratulating the proprietors on the wisdom of their decision in adopting this mode of locomotion. Mr. George Garnett, who was largely instrumental in introducing electricity to the pier, retired from the board of directors, and he was warmly thanked by several speakers for his efforts on behalf of the company.

Winthrop, Mass.—A dispatch of June 26 says: This week has been a most eventful one in the history of this little town. Yesterday Governor Robinson signed the charter for the Winthrop Electric Street Railway Company, which is the first charter granted in the State of Massachusetts for an electric railway, and the first ever granted in the world for an electric elevated railway. The citizens of Winthrop may well feel proud, and last evening they celebrated the event by a display of fireworks and a band concert in the public square. E. H. Doolittle, the originator of the electric scheme, has shown the most indomitable pluck in the way in which he has fought all opposition to this new mode of transit. Since Mr. Doolittle's residence in town he has taken a lively interest in all town affairs, and more of such men are greatly needed in the town. The new road will fill a long-felt want of the citizens of the upper part of the town—that of rapid transit to and from their places of business.

Electricity as a Motive Power.—In a bright article on this subject in the Boston *Globe*, Mr. Robert Luce says : "It is cheaper to free the caged energy from coal in one big furnace than in a dozen little furnaces burning the same gross amount. Under a stationary boiler can be burnt fuel cheaper by one-half than that burnt under the locomotive boiler. The stationary engine gets more energy out of coal weight for weight than the locomotive engine. One big engine wastes less power than a dozen little engines of the same gross capacity. It is cheaper to send power along a rail or wire in the form of electricity than to haul it along the track locked up in coal. The electric motor is lighter than the steam locomotive, power for power, and with lighter rolling stock the road-bed or elevated structure can be lighter. To offset all these gains there is the loss in converting steam power into electric power, transmitting that power and then turning it into mechanical motion. Both figures and experience prove, however, that the loss does not nearly balance the gain. The saving in cost of fuel alone is greater than the value of power lost. Other savings add to make electricity far the cheapest motive power ever known."

PERSONALS.

Mr. Frank Jones, who is and has long been prominently connected with South American telephone interests, is on a visit to New York again.

Hon. W. A. Phillips, ex-member of Congress, and a well-known writer on political economy, has an article in the July *North American Review* in favor of government control of the telegraphs.

Mr. Samuel Elder, so long associated with Mr. Edwards H. Goff as private secretary, has tendered his resignation, and now, we understand, contemplates, in company with Mr. F. Montague Sowden, late Treasurer of the American Electric and Illuminating Company, of Boston, entering into the business of electric light construction.

Mr. A. C. Terry, of the Western Union service at Buffalo, gave a lecture last week on the "History and Development of the Telegraph" before the Toledo Electrical Society, of which he is an honorary member. It is needless to say that the lecture was very interesting, and was heartily enjoyed. Mr. Terry illustrated his lecture with some fine drawings of his own execution.

Major Thomas H. Winsor, late of Buffalo, N. Y., but now electrician for the Atlantic Telegraph Company, was married at Cape Elizabeth, Me., on June 12, to Miss Josie D. Hayes, of Cape Elizabeth. Rev. Mr. Smith officiated, and the wedding was attended by the relatives and a few friends from Baltimore, Boston and Portland. The bride and groom were made the recipients of many handsome presents, conspicuous among them being one from the Atlantic Telegraph Company, made through its President, Hon. John W. Deering, and also a beautiful one from Supt. C. S. Jarvis, of the same company. There was a heavy snow-storm of congratulatory telegrams. The happy couple will make Portland their future home.

Two Notable Men.—Some "Men About Town" gossip in the New York *Tribune* says : "I met Gardiner Green Hubbard recently, and, recalling what he had done for the Bell telephone, wondered if he would ever get his full share of credit for the introduction of that important invention. Professor Bell may be said to have made the telephone; but Mr. Hubbard breathed life into it. Bell made it speak, but Hubbard did quite as much in supplying its worlds of listeners. It was a toy till Hubbard made the telephone a power—time-saving, labor-saving, money-saving. It is to-day a great public necessity of immense commercial value, and made so largely by Hubbard's ability as an organizer. Everybody recognizes this to a certain degree of Mr. Hubbard. The public is coming gradually to recognize, in the same way, the force and power of Edwards H. Goff, of the American Electric Manufacturing Company, in the field of electric lighting."

Mr. Edwin Cowles, President of the Cowles Electric Smelting and Aluminum Company, paid a visit to Lockport, N. Y., recently to inspect the new works now in course of construction there for the company. In conversation with the editor of the local *Journal*, he said he had just returned from Europe where he had been traveling with his family, combining business with pleasure. He had secured patents in all the European countries for extracting this metal by the Cowles process; and had taken over a dynamo and established preliminary works at Antwerp, Belgium, to prevent the patent lapsing in that country. His son, the originator of the Cowles process of extracting aluminum, had delivered lectures before several scientific societies in Europe ; had received several honorary medals, one of which he prized very highly, "The Count Rumford Medal," which was bestowed for merit in original discovery.

MISCELLANEOUS NOTES.

Cheaper Zincs.—A rich vein of zinc has been struck at the Cape Rosier mine in Castine, at the edge of a drift which has been run in some eighty feet. One of the men accidentally stuck his pick into the ground, when he discovered almost a solid bed of zinc. Mr. Vague, superintendent of the mine, says that the vein will assay 50 per cent zinc. He has sent to New York for men to work it.

An Australian Method of Running Wires.—It is stated that all the poles are being taken down in Sydney, New South Wales, and that the wires are to be inclosed in a case-like frieze along the house fronts, covering the wires and giving the cornice of the houses a more ornamental appearance. This plan is not new, however, being already known in Europe. It may answer where there are not a great many wires to deal with.

A Paraffin Photometer.—Messrs. Yeates & Son, of Dublin, have constructed for Dr. König a photometer, which the latter considers superior to that of Bunsen. It consists of two quadratic prisms of cast paraffin, connected together on one side and having between a leaf of silver or tinfoil. Light from one source falling on one of the prisms makes it appear clear white by the reflections; and as the metal sheet intervenes the light cannot penetrate to the other prism, which therefore appears dark. But a second light placed on the other side can make the other prism appear equally bright; and the relative distances of the two lights from the prisms by the law of inverse squares gives the ratio of the intensities of the two lights.

New York Subways.—More plans for putting telegraph wires under ground were presented to a meeting of the Electrical Subway Commission on June 23, the Hon. Roswell P. Flower presiding. President Wallace, of the Wallace Telephone Company, brought forward a big project. He was in favor of a tunnel running through the city which should be large enough not only to meet the demands of electric wires, but also accommodate water mains. Mr. S. F. Shelbourne, who has appeared before the commission hertofore, explained his conduit system, consisting of a wooden box covered with asphalt, and then given a further coat of zinc. Professor Jaegel suggested conduits under or beside the street railroad tracks. Mr. Flower has prepared a set of resolutions governing the procedure of the commission in its work.

Electric Resistance of Alcohol.—M. Foussereau has continued his researches on the resistances of some of the bodies in general use and has established that the resistance of alcohol varies greatly, not only with the percentage of water, but much more with the slightest trace of salts—especially alkalies—and of acids. The specific resistance of a good alcohol is between 2.5 and 3.68 megohms, but one sample, specially distilled in a copper still, purified over lime and baryta, gave a resistance of 7.031 megohms, which fell to 2.823 after the alcohol had for two hours been kept in a glass bottle. Porcelain vessels do not influence the alcohol ; from glass the alcohol dissolves traces of alkali sufficient to frustrate any determination. M. Foussereau had established that for distilled water and some fused salts the resistances vary as the co-efficients of internal friction; for alcohol this co-efficient varies much more rapidly than the resistance.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations of the New York Stock Exchange, Boston Exchange and elsewhere are as follows :

Telegraph.—B. & M., b 2, a 3; Western Union, b 63⅞, a 64.

Telephone.—Am. Bell, b 188, a 188½; New England, b 34; Mexican, b 1, a 1⅛.

Electric Light.—No new quotations.

BUSINESS NOTICES.

OFFICE OF BULLOCK & CRENSHAW,
Chemists and Importers, 528 Arch Street,
PHILADELPHIA, Pa., Jan. 19, 1886.

Smith & Shaw Elect. Co.—*Gentlemen :* We think that the features of the *Closed Cell*, and regulation of the current by a graduated scale, give your Pocket Batteries advantages over competitors, and especially recommend it to all physicians for use in their practice. Of all that we have sold, we do not remember to have had a single complaint, but on the other hand, we have received many commendations of them from those who are actually using them every day with the greatest comfort and satisfaction. Yours very truly, BULLOCK & CRENSHAW.

Hill's Hair and Whisker Dye
Colors to any natural shade of black or brown, 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure; 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.